AUSTRALIA'S DYNAMIC ELECTRONICS MONTHLY!

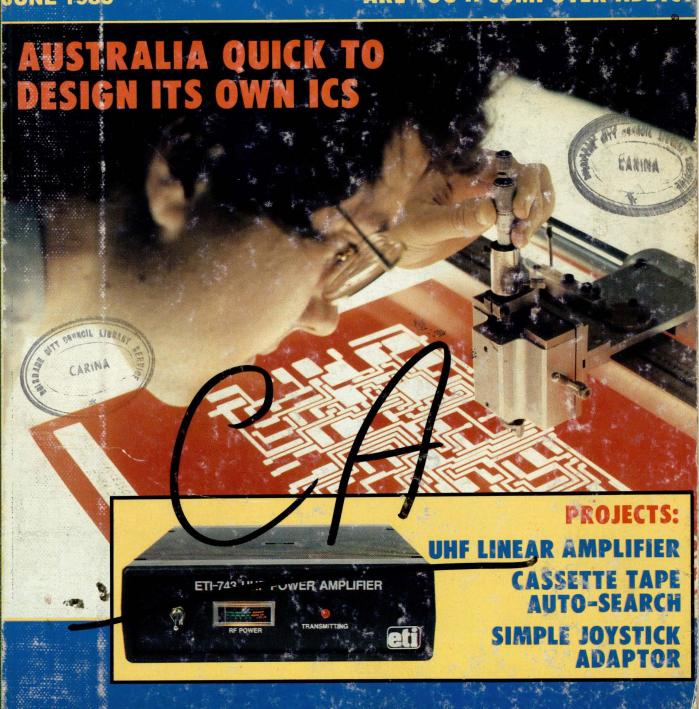
ECTTOLIC WRIS

\$2.75* NZ \$3.50



WRISTWATCH COMPUTER
WALL-HANGING HI-F
— TWO REVIEW
RADIO VIA SATELLIT
ARE YOU A COMPUTER ADDICT

JUNE 1985



ADVERTISERS'

A. Hankin & Co	56
Active Electronics	
All Electronic Components	128
Altronics	
Applied Technology	
Associated Calibration Sale	
Audio Engineers	
Australia School of Electror	
Australian Electronic Comp	
Autotron Australia	
Daneva Australia	
Delsound Pty Ltd	127
Dick Smith Electronics	IFC,40,41,
Disco World	45,50,117
Electronic World	
Emona Instruments	
Energy Control	
Epson Australia	
ETI Books	116,123
ETI Offers	51,91,100
Federal Publishing Co	
Geoff Wood Electronics	
Hewlett Packard	
lan Huntley Pty Ltd	
I.E.I. Australia	
Jaycar Electronics	97,112,113
Leisure Imports	44
Marantz Australia	
Microtrix	
Plessey	
Positronic Computers	
Prepak Electronics	
Robert Ford	
Rod Irving Electronics	94,95,118
Rose Music Pty Ltd	10.11
Scan Audio Pty Ltd	
Scientific Devices	
Siemens Ltd	
SME Systems	
Sony Australia	
Union Carbide	
Wireless Institute	123

This index is provided as an additional service. The publisher does not assume any liability for errors or omissions.

N ABOUT THIRTY SECONDS the groans will be heard around Australia, emanating many from the top floors of electronics and other so called high technology companies. That's because I am about to pontificate on that most sacred of holy cows, high-technology manufacturing.

In the 1940s many Australians were impressed by the power that the ability to manufacture motor vehicles and other machinery apparently gave a country. As a result of these emotive rather than economic reasons we now have a heavily subsidized car industry.

We pay more than \$25,000 per year per worker to keep the industry going. But that is only half the cost; we all pay \$4000 to \$6000 more than we need to when we buy a new car, leaving us less money to spend with other Australian manufacturers.

Tariffs and other barriers to imports serve more to protect other countries from Australian competition than they do any good for the Australian industry.

We cannot apply tariffs to protect industry and not expect any adverse side-effects. The very fact that these measures limit imports means the value of the Australian dollar will be artificially high.

Any manufacturer that might have had a chance to export now has a barrier that prevents him from doing so. What's worse is he now has to compete for resources, like skilled personnel, with operations that could not have survived otherwise.

We are so used to having a piddling level of exports that we don't consider the export market important. Our local market is so small it makes the world market look infinite by comparison. We only need a few products to be really competitive on the world market to have a huge electronics industry.

It would also be a much more interesting industry to work in, because we would be running a complete research, manufacturing, testing and marketing operation instead of the hand assembly shops we seem to be lumbered with under tariffs.

The major part of the Australian electronics industry has developed ad hoc with particular manufacturing operations to suit particular local needs. Most don't get any tariff protection now and would only be helped by the reduction or abolition of tariffs.

Ironically it is precisely those who most profess the need for free enterprise that are the first to ask for government intervention. Is it that our pillars of industry are just closet socialists?

It is never easy to argue against the widely held beliefs of your peers, but for the Australian electronics industry the argument is vitally important.

I look forward to the comment of industry in these pages.

David Kelly Editor

SERVICES

TECHNICAL INQUIRIES: Technical inquiries by mail must be accompanied by a stamped self-addressed envelope. There is no charge, but we reserve the right to publish the inquiry and the reply in Electronics Today or any of its associated publications. We can only answer queries relating to projects and articles as published. We cannot advise on modifications, other than errata or addenda. Difficult questions may take some time to answer.

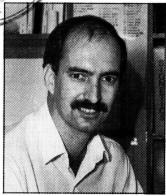
GENERAL INQUIRIES: For all inquiries about back issues, subscriptions, photocopies of articles, artwork or submitting articles, call (02) 663-9999 or write to: ETI Reader Services, 140 Joynton Avenue (PO Box 227), Waterloo, NSW 2017.

CONTRIBUTIONS: Submissions must be accompanied by a stamped, self-addressed envelope. The publisher accepts no responsibility for unsolicited material.

COPYRIGHT: The contents of Electronics Today International and associated publications is fully protected by the Commonwealth Copyright Act (1968). Copyright extends to all written material, photographs, drawings, circuit diagrams and printed-circuit boards. Although any form of reproduction is a breach of copyright, we are not concerned about individuals construct-

ing projects for their own private use, nor by bands (for example) constructing one or more items for use in connection with their performances. Commercial organisations should note that no project or part project described in *Electronics Today International* or associated publications may be offered for sale, or sold in substantially or fully assembled form, unless a licence has been specifically obtained so to do from the publisher, The Federal Publishing Company, or from the copyright holders.

LIABILITY: Comments and test results on equipment reviewed refer to the particular item submitted for review and may not necessarily pertain to other units of the same make or model number. Whilst every effort has been made to ensure that all constructional projects referred to in this edition will operate as indicated efficiently and properly and that all necessary components to manufacture the same will be available, no responsibility is accepted in respect of the failure for any reason at all of the project to operate effectively or at all whether due to any fault in design or otherwise and no responsibility is accepted for the failure to obtain any component parts in respect of any such project. Further, no responsibility is accepted in respect of any injury or damage caused by any fault in the design of any such project as aforesaid.



Aussat countdown

As the dust slowly settles on the controversy surrounding the technical standards for TV broadcasting from Aussat, the fight over how the satellite is going to be used is hotting up. Essentially there are three contestants: the big city networks, the regional broadcasters and the rest of us. Piggy in the middle is the government, represented by the Department of Communications, and the Australian Broadcasting Tribunal.

The big three city stations want it all for themselves. They would like to be able to network to terrestrial ground stations and do direct broadcasting to remote receivers. Advantage: more money for them, and the same service all over the country. Disadvantages: the end of the regional broadcasters and an increase in the already incredible monopoly situation of broadcasting in this country.

Regional broadcasters would prefer it if Aussat became geostationary on the bottom of the South Pacific ocean very soon after launch. Since this is unlikely to happen they would prefer it if there was no direct broadcasting via the satellite at all. That is politically untenable, since Malcolm Fraser used direct broadcasting as the carrot to spur the electoral donkey into paying for it all those years ago. Option three: preserve the regional broadcaster's monopoly

by using the addressing capabilities of the BMAC transmission system, and make it illegal for people inside their reception zones to receive signals outside.

Option three was Communications Minister Duffy's favourite compromise until his secretary Bob Lansdowne told an industry seminar he foresaw policing the policy as a "nightmare". He regaled the conference with stories of the Canadian experience, which had mounties clambering through the backyards of rural Canada looking for dishes pointing in the wrong direction.

After dithering around for years the government decided that the best way to do things would be to form separate commercial broadcasters out of consortiums of the rural broadcasters and let them run the satellite channels. However, it now appears that the rurals' response has been to form themselves

The areas covered by the four spot beams from the satellites plus another spot beam for Papua New Guinea.

Maco City Earth Staturs

Tracking Teamethy Control & Monstering Staturi

into one large network. And it seems that the government has accepted that that is the best deal it can get from the broadcasters.

The idea is that the regional commercial network will apply for all the regional licences that have been granted, and presumably with government blessing, get them all. Advantages: they will be able to compete with the big city networks, and they won't lose their monopolies. Disadvantages: the country cousins get only one commercial channel plus the ABC.

And the people? Well the people pay for it all, and get as few channels as the networks can get away with.

Plans for new telescope

Work begins next year on a new generation optical telescope. It is the most significant leap in size for almost a generation, when the two hundred-inch Hale telescope atop Palomar mountain was unveiled. Since then only one bigger instrument has been built, by the Russians. But it used conventional technologies and came up against the same engineering problems that constrained the Palomar designers. The new instrument will

be ten metres across.

The problem has always been to support such a huge weight of glass to tolerances within a few wavelengths of light. As the telescope is shifted about its axis the stress on it changes. When the wind blows, or the temperature changes, all the dimensions of the lens alter.

The proposal that has led to megascopes has been to build not bigger, but smaller lenses. These can all be controlled separetely and integrated into one huge lens.

The American project has been made possible by a \$70 m bequest from the W. M. Keck foundation of Los Angeles. The telescope will consist of 36 hexagonal mirrors designed by Jerry Nelson, an astronomer. Each segment will be 1.8 m across, and positioned relative to its neighbours to a tolerance of less than 3.75 nanometres. The segments are repositioned 300

times a second.

The Keck telescope will be the perfect complement for the space telescope to be launched next year. The space telescope will have 10 times the resolving power, because it will be above the atmosphere. But the Keck telescope will have much greater light gathering power, so important when looking at exceptionally faint objects.

Ballistic transistors

The world's electronic press has been abuzz this month with an anouncement from Cornell Univesity in the United States that Gallium Arsenide transistors have been developed with a switching time of about 1.5 ps (1.5×10^{-12}) .

This is so fast that it would require a major rethink of computer architecture; it is expected that the biggest computers in existence today could be shrunk to the size of a lap top. Other immediate applications would be in satellite technology, where it would be possible to transmit in the 94 GHz band, where atmospheric attenuation is at a minimum.

The technology is based on

the ballistic electron effect. Electrons in such devices travel about six times faster than they do in conventional transistors. The increase stems partly from the inherently faster transit time of GaAs material, but mostly from the travel paths, which are so small that collisions with other subatomic particles become insignificant. As a result, the electrons begin to speed up as they travel. The electric equivalent is that of feeding current into zero resistance.

Fundamental work on the idea of ballistic transistors was done at Cornell. Important advances have also been made by Bell and CNET in Grenoble, France.

Charon exists

In the old legends Charon is the ferryman who takes the souls of the damned across the river Styx to Hades, ruled by the implacable Pluto. Modern astronomers have it that the Greeks got it all wrong. Pluto rules a hell that is not hot, but frigid cold, and Charon, far from being the ferryman, is a companion engaged in frenetic dance, pirouetting about Pluto every eight hours.

Pluto, furthermost planet from the sun was discovered by Percival Lovell in 1930. It is so small and so far away that no pictures exist of its surface, and astronomers have only a hazy idea of its size. However, watching the intensity of light coming from the planet, scientists have been convinced for quite a while that there was something distinctly odd about it. The suspicion has been growing for quite a while that the planet was either strongly marked, or strongly deformed, or maybe not one, but two distinct bodies. Supporters of the latter school christened the new body Charon, but have been unable to get official recognition of the name, since no visual proof of its existence could be produced.

Now a series of eclipses has been observed, and the existence of a moon directly confirmed for the first time.

The reason that proof has been so long in coming is that Charon orbits in a curious manner, such that it actually only eclipses Pluto for five years in every 124. The initial work on the orbit of Charon was done in 1978 by Jim Christie at the US Naval Observatory. He argued from the pattern of light intensity coming in from Pluto that if Charon existed, it would have this peculiar orbit. He predicted that eclipses would start in 1982.

In line with his predictions, a team of US astronomers began a joint effort to detect the eclipses in early 1983. After early errors and inaccuracies caused by calibration problems in the telescope and other uncertainties, the team has now announced the definite existence of an orbiting body.

Scientists are excited, not only because of the discovery of another major object in the solar system, but also because the existence of a moon will allow accurate determination of the mass of both bodies, their size and thus density, and from that, some idea of their composition.

But whatever is determined, Pluto and Charon are certainly small, and cold, and a long way away.

Hands on custom chips

The Centre for Industrial Microelectronic Applications, (CIMA) is offering hands on experience to people wishing to use custom chip technologies in their circuits. Appropriate CAD workstation development tools are available for use under the guidance of technical staff. Charges are minimal owing to inputs from both Federal and Victorian governments. For more information contact CIMA on (03)660-2991.

3 x 3 LSI

Mitsubishi Electrical Corporation has reported the development of a three dimensional, large scale integrated device. A new process has been applied to three devices, one of which has three layers. This makes it the first time a three layer, three dimensional LSI device has ever been constructed. The work is part of a ten year development program for future industry.

Scholarships to Eindhoven

Philips International Institute of Technological Studies is offering places for study towards a Masters Degree at Eindhoven in the Netherlands. Since its foundation in 1957 thirteen Australians have been awarded scholarships. Prerequisites include a good electronics degree and competency in English.

Recycling silicon

Europe's first purpose-built plant for the recovery of old silicon wafers has come on-line in Riddings, UK. According to the principal of the company running the operation, significant cost savings result from stripping and repolishing silicon wafers.

Data services directory

Telecom is updating its directory of computer based data services accessible through AUSPAC. The directory was first issued last year and covered most of the data bases available. If you missed out then contact Graham Martin on (03)606-7772.

Asian computer market conference

Hundreds of the world's leading information and communications suppliers and experts will converge on the World Trade Centre in Singapore to compete for a share of the Asian market worth a reported \$6.5 billion. The conference will run from September 3 to 6. Full details for exhibitors can be obtained from BPI exhibitions, (02)266-9799.

Electronics exhibition in Melbourne

The 20th International Electronics Exhibition and Convention begins Monday 30 September in the Royal Exhibition Buildings, Melbourne. According to organizers only 9% of space is left for exhibitors. Alan Stoops, chairman of IREE-CON '85, expressed satisfaction with the way things were going and with the direction of the papers to be presented at the convention. He said it all reflected the fact that IREE-CON '85 will be the largest exhibition in the Southern Hemisphere this year.

Prizes, prizes

Mr David Josling has won the DSE "everybody's a winner" contest. His prize includes a CAT personal computer and a trip for two to the UK.

COMPANY NEWS

Cybernex of Canada has selected Datatel as the Australian distributor for its range of Hi-tek visual display terminals. Cybernex manufactures terminals compatible with IBM, Honeywell, etc. Datatel is at 19 Raglan St, South Melbourne, on (03)690-4000.

Allen Bradley Ltd, supplier of resistive components has announced the appointment of K. D. Fischer Ltd as its SA distributor. Included in the range are fixed and variable resistors, resistor networks and trimpots. It also sells the Australian assembled Mod Pot range of potentiometers.

Arista Electronics has moved its offices to 57 Vore Street, Silverwater, Sydney. The new phone is (02)648-3488. Telecom has appointed Mr Harry Wragg as director of research to replace Ed Sandbach who resigned recently. Mr Wragg has been assistant director of business development since 1983.

Philips announces that its data systems, electronic systems and radio departments have been combined into Philips Communications, based in Carroll Road, Oakleigh South, Vic 3167. Sales is on (03)542-3600 and service on (03)542-3650.

Telecorp, the Australian communications manufacturer, has announced the appointment of a national dealer network. To find out who your local dealer is call Telecorp in Sydney on (02)450-2522

Arlec Ltd has appointed Jewel distributors as its agent in the Northern Territory. Arlec manufactures a range of electrical and electronic goods. To contact it call at Unit 2, Lot 1737 Albatross St, Winnellie, NT 5794 or phone (089)84-4227.

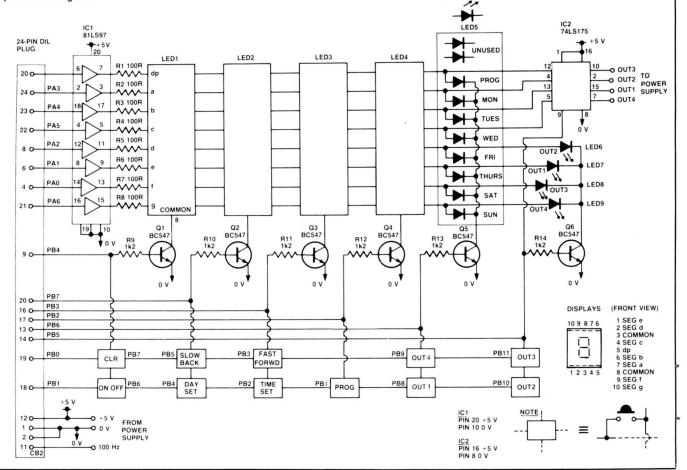
NOTES & ERRATA

Project 662B, April '84. The circuit diagram for this project, page 74, contained an error. The pushbuttons are labelled incorrectly. The correct positioning is detailed below. The pc board artwork shown in the original article is correct.

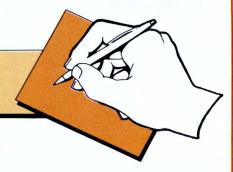
Other minor corrections are: Pin 20 of the 24 pin DIL plug is the PA7 connection. PB4 is on pin 9, not pin 15 as shown. IC1, pin 1 should be pulled down to ground.

Project 677, January '85: On page 76 the input connection attached to pin 6 of IC2c should be labelled STROBE-bar. The corresponding Centronics connector pin number should also be 1, not 10, while the Centronics pin number for the BSY output line should be 11 not 1.

If the Catterbox is to be used with a VZ200 computer, capacitor C1 should be reduced to 100p to allow the circuit to trigger reliably from the narrower strobe pulse. Note also that the BASIC interpreter normally sends a CR-LF combination to the printer when returning to READY after running a program. This causes the Chatterbox to produce a continuous sound, even if your program leaves it silent. The solution is to end your program with a dead loop line (e.g, 1000 GOTO 1000), and break it using the CTRL + BREAK keys.



Letters to the Editor



BMAC, be careful

JON FAIRALL is to be congratulated for his article "BMAC — We'll be the first to use it," March 1985. The article was informative and covered the areas of the introduction of satellite broadcasting into Australia very well.

The BMAC decision was brave, hopefully it doesn't prove to be foolish. Now that the Americans' plans for DBS have been shelved, Australia is going BMAC alone, Europe is debating the issue of broadcasting standards via satellite and the only other 12 GHz systems are based on NTSC primarily using Japanese technology.

It appears that the most advanced Japanese manufacturers are more interested in the step beyond MAC, high definition TV, rather than entering the ever confusing debate on the different forms of MAC.

It is to be expected that the confusion over universal standards may be cleared later this year at the CCIR conference — with results that may well see Australia either on its own with BMAC or being the first with a widely accepted system.

Experience from the Japanese though, was not heeded by our governing authority. In Japan the manufacturers preferred to put in an interim system (readily available to Australians if necessary) and change to the very high tech HDTV when available, rather than go one way and take the risk of either isolation, or backtracking.

The new issue of this debate is that of 'equalization', a just recently announced policy of the DOC which may result in the MAC system being used only for HACBSS, with all other broadcasting using lower cost Japanese systems.

The decision to be first to use the BMAC system will raise the cost to all users. Before the BMAC alternative was decided upon, we put a proposal to the Department of Communications outlining the basic Japanese developed system which would cost the end user approximately \$1700 not including government duty and tax charges but in-

• The BMAC Baseband Processor, on the other hand, will have a basic factory cost of around \$500-\$600 which will end up costing the end user an additional \$1000 by the time transport, re-handling and retail charges are added because of the small quantities involved to supply the Australian market, and the hi-tech nature of BMAC with the devel-

cluding transport and retail charges.

opers of the system having to recoup their R&D expenditure.

For the same \$1000, an interested consumer could purchase a larger 2.5 m antenna and servo control unit to redirect it and be able, if the government allows equalization to follow its course, to pick up all three national broadcasters (if Aussat and the networks can agree on prices for transponders, all using the basic Japanese system adapted to PAL). Then in a few years when the CCIR has released its policy guidelines, all Australians can enjoy the benefits of an internationally accepted system at very low cost which will keep us well satisfied until the HD and digital TV systems are introduced in 1990.

Jeff Lillis Product Development Specialist, Toshiba, Australia

I HAVE recently returned from a two-year period abroad and brought back a Sony Trinitron Colour TV receiver, KV-2024E and Sony Beta videocassette recorder SL-C7E, which I bought in Singapore one and a half years ago.

Though both TV and VCR work and I can pick up CTC-7 and SBS-28 here in Canberra, I cannot pick up ABC-3. I have no trouble with an older TV which I have. All I can get of ABC-3 on the Sony is a vague picture and the sound. Also the picture on CTC-7 and SBS-28 has a greenish hue.

When I bought the sets I was assured that they were alright for Australia but I now suspect that was not entirely true.

I am almost totally ignorant about the mysteries of electronics. I have been informed by a Sony agent here that I need a kit which would cost about \$180.

I would be most grateful if you could advise me on what, if anything, is wrong with the equipment and what I need to put it right to suit Australian conditions and what I might reasonably expect to have to pay.

M. R. Freeman, Curtin, ACT

It's of considerable embarrassment to the Department of Communications that we are the only country in the world to have allocated part of the international FM radio broadcasting band to television (channels 3, 4 and 5). To prevent visible interference to television channels around 7, 8, 9 and 10, overseas video recorders and receivers have

a filter (between the aerial socket and the tuner) for the FM broadcasting band (88 to 108 MHz). These recorders won't work in Australia for television channels 3, 4 and 5 unless the filter is removed. — Ed.

And the answer lan . . .

ON PAGE 66 of the article on CDIs in the February '85 issue, Ian Thomas asks "If this type of inverter has all these advantages then why hasn't it been used before?". The answer is that it has. See the RCA application note AN-6288E published December 1974. As you can see it is very similar in principle (although less refined) than the design published in the February '85 ETI edition.

G. J. Shepherd, Newtown, Tas

With some suggestions

I HAVE read Part 1 of the "Improved CDI" with interest. On page 66, the question, "Why hasn't this system been used before?" is answered by "It has. See AWA 'Radiotronics' August 1969, page 45".

I have been using this circuit, with small mods, since early 1970, along with several colleagues. My original unit is still in use, but now with a Hall effect device. There has never been any hint of cross-firing.

The two main differences between it and your new circuit are the use of an easily wound transformer using EI laminations and the use of the points to stop the inverter whilst the plugs are fired.

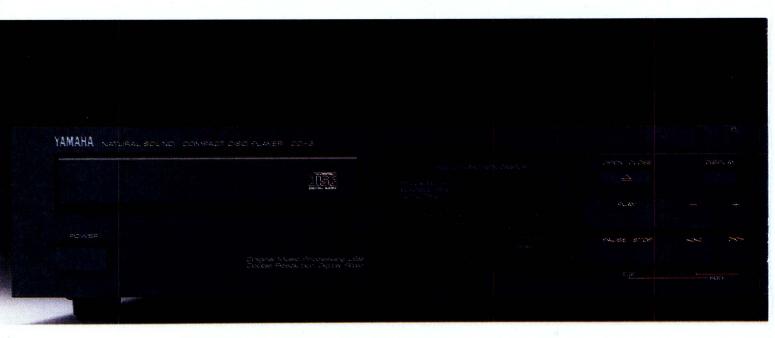
An unmentioned advantage of this type of circuit is the low current drain under stalled engine conditions. TAI systems need to turn themselves off if not fired within a reasonable time; a circuit in *Elektor* several years ago, did make this safety provision.

A short-coming in your circuit as published: although OK in the points version, the mods to R13,14 for using a Hall effect device would preclude the use of three other now essential circuits: tachometer; air-conditioner low speed clutch release; and cruise-control (manual transmission).

I am presently using a BD139, switched by the Hall effect device, to switch my equivalent of R13, with the connection brought out for use.

G. A. Tidy, Murrumbeena, Vic





They sound even better

Forget the price, a digital disc player is only as good as it sounds.

And how well it sounds depends on how well it converts the digital signal to an analog signal.

It's as simple as that. (Providing you understand it!)

Both the Yamaha CD-X2 and CD-3 digital disc players feature Yamaha's superbly engineered and much praised LSI (Large Scale Integrated Chip).

This LSI converts the digital sound to an analog signal at twice





with these attachments.

the rate of its competitors. This oversampling virtually eliminates phase distortion, greatly improving playback resolution.

It also eliminates the need to pay any more than between \$499* and \$699* for a digital disc player. For more information, please send the coupon to: Rose Music, 17 Market St., Sth. Melbourne, 3205.

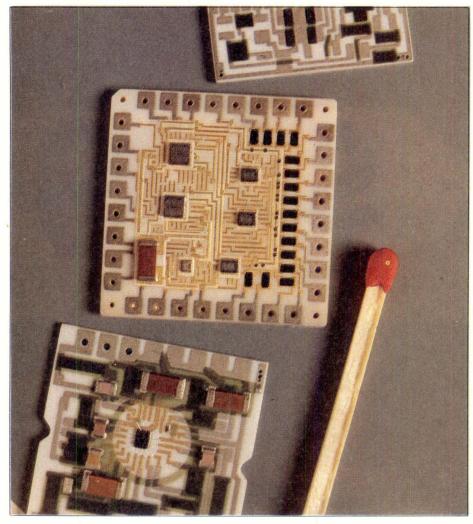
Name_

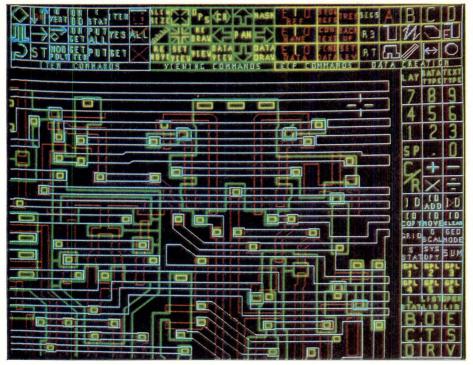
Address_

Postcode

* Recommended retail price. * Silver model available.







Above. Some typical hybrid circuits, with a match for comparison.

Below. Screen output of a CAD system used in designing integrated circuits. (Courtesy Plessey)

New technologies are changing the face of electronic manufacturing. During the next few years the humble 'board stuffer' will become an endangered species as automation and miniaturization take their toll.

SO, YOU'VE finished it. You have your prototype. It's full of ad-hoc resistors but a thing of beauty nevertheless. And you have your manufacturer.

Many a brash young man finds out at this stage of his designing career that the fun is only just beginning. Choice and compromise is the name of the game.

What services can a manufacturer offer you? What questions will he ask? How much will it cost?

On the way to answering these questions ETI discovered a world in flux. A revolution in the way circuits are integrated and constructed is occurring in electronic manufacturing. Over time it's becoming cheaper and easier to put part or all of a design on silicon.

Traditional assumptions that integration is always too expensive to be considered are eroding. The humble pc board is under threat.

A sign of the times: in February the giant National Semiconductor Corp predicted that custom designed chips would account for 25% of the total market for ICs this year. That's a quarter of \$US34 billion, the kind of money that makes people sit up and take notice.

The changes are not the result of great scientific breakthrough. By and large they depend on well understood technologies. What is happening in electronic manufacturing today is the application of novel techniques to old problems.

It's a development that Australia has been quick to capitalize on. In fact some pundits see the new technology as the saviour of the Australian electronics industry, the great equalizer in fact. Enthusiasts predict that using new developments in micro technology will allow us to compete with overseas countries without the dead weight of small markets and high labour costs.

Whether that is so remains to be seen. What is for sure however, is that integrated circuit technology is entering a revolution. And in any revolution there are winners and losers.

New techniques

It's possible to categorize the new technologies in order of the number of units required to make them economical. There are

Hybrids — laser trimming

When boards get small, real estate gets valuable, too valuable to waste on discrete resistors. This line of thinking has led to a technology producing extremely small and very accurate resistors.

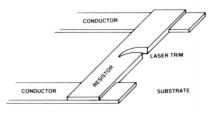
After the tracks have been laid on the board as described in the main text, a block of resistor paint is screen-printed onto the board between two tracks. Since resistance is related to length and cross sectional area, the resistance can be predetermined.

Unfortunately it's not particularly accurate. In fact the resistance between the conductors cannot be guaranteed to better than 25%. Since this could be quite a design problem steps need to be taken to increase accuracy. The method is known as laser trimming.

In a laser trimming process the original blob of paint is made bigger than it should be, so that resistance is definitely lower than required. Two probes are attached to the conductors so that resistance can be accurately determined. Then a laser is used to cut a wedge in the paint.

As the laser cuts the paint away the total resistance of the pad increases. As the resistance approaches the required value the laser power is reduced and the groove is bent around in a longitudinal direction so that the process may be controlled more precisely.

Using these techniques it is possible to control the value of the resistance to better than 1%. It's almost totally automatic and can be done in about five seconds. Ain't science wonderful?





A typical work station for the design of integrated circuits. Such CAD systems make much modern integrated technology possible.

components. Once again the idea is that the designer can implement any function simply by connecting together sufficient cells.

GAs can certainly get your circuit design onto silicon at a fraction of the cost of a fully customized chip, but they suffer from a building block character. In any particular design unused space is likely to abound. Propagation is likely to be long compared with a custom design because of the number of gates. A more elegant solution is the standard cell.

Standard cells

Manufacturers have been offering standard cell facilities overseas for the last few years, and they have recently become available in Australia. It's a technique which tries to implement many of the features of the GA while preserving the efficiency of the custom IC.

A standard cell can be thought of as a simple functional block, a logic gate, a flip flop, counter or whatever. The designer selects these from a standard cell library, and puts them together the same way as a normal circuit is put together.

The circuit is given to the manufacturer who then arranges the standard cells on the silicon to create the semi-customized chip. In fact, to all intents and purposes it is a customized chip. The main difference is in the design process. Instead of man-years of labour designing in silicon the same job can now be done in weeks. The savings are astronomical.

MPC

Another new option is the multi project chip. These have been made possible by vary large scale integration and essentially consist of a number of completely separate designs on one chip. The silicon is divided up into a number of areas, each functionally independent of the other, down to separate input/output arrangements.

The function of the chip is then decided only at the bonding stage. Bonding is the process of connecting the silicon to the outside world by microscopic wires running between the silicon and the pins.

The idea of the MPC was first proposed by Lynn Conway and Carver Mead in the USA, and imported into Australia by Dr Craig Mudge. Mudge spent a number of years with the CSIRO developing the Conway-Mead idea before spinning off a separate company, Austec, to exploit his experience in custom chips.

CAD

The key element in all these technologies is the computer aided design system. From the point of view of the user, this consists mainly of a monitor and touchpad. The operator is usually presented with a menu from which logic or linear symbols may be selected and positioned on the screen. It's then a simple matter to draw in the interconnections between them.

Whatever the details of the particular CAD system, the philosophy is always the same: to reduce the time and cost necessary to turn an idea into silicon.

In the nature of the game, not all systems are equally good at achieving these goals. It's an area that is red hot in research circles as academics hunt for kudos and the elusive silicon compiler.

A silicon compiler would be just that: a device that would take your design and compile it on silicon. It's an area that has particularly interested Australian researchers, both in industry and the universities.

For instance JMRC, the Joint Microelectronic Research Establishment, set up by the University of New South Wales and the

Melbourne Institute of Technology, has had a large research team working on the development of a new CAD system for about a year, according to UNSW Professor Graham Rigby.

Current expertise at JMRC is the ability to compile about 1000 transistors on a wafer. "It won't be optimum", says Rigby, "but it will be error free". This is not quite the best ever achieved, but in terms of international experience, it puts JMRC into world class.

The problem with obtaining a silicon compiler is just one of complexity, that is, it's not difficult to see how it should be done, just difficult to do it. Difficult because there are so many design options.

In fact, the computer is being asked to simulate the partially intuitive function of a human designer. Thus, according to Rigby, the final solution to really large scale designs will probably have to await the arrival of artificial intelligence.

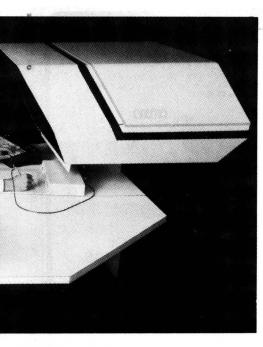
The industry

Australian industry can offer all these technologies to a designer with prototype burning a hole in his pocket.

Plessey Pacific is one of four manufacturers of hybrids. Staff there are in the middle of an extensive upgrading of the facilities of the plant.

According to Clyde Witcombe, design engineer in the Hybrid Unit, current plans call for the introduction of Calma CAD equipment to ease the task of designing hybrids, as well as the introduction of SMD techniques.

Another producer of hybrids is Hybrid Electronics in Melbourne. According to manager Wally Berryman, the company produces about 5000 hybrids a week. The smallest production run is about 100. He



*strongly supports the use of chip and wire technology, claiming it represents a better blend of reliability and economy than SMD techniques.

A few manufacturers have the capacity to manufacture complete custom chips. AWA for instance is engaged in the manufacture of custom chips for the BARRA Sonabuoy Project for the RAN.

In Adelaide, Austec offers full custom VLSI facilities. So far applications have included signal processing, computer graphics and disk controllers. Many other applications are reportedly in the pipeline following an aggressive marketing strategy by the company. The MPC technology pioneered in Australia by Austec's director, Craig Mudge, is now done by AWA.

Texas Instruments and Philips have joined together to offer semi-custom services. TI recently introduced its custom cell library to Australia. This is a CAD system especially designed to run on the IBM-PC. It comes in the form of 51/4-inch floppy disks which give the designer access to all the building blocks in the TI/Signetics cell library. (Signetics is the Philips US subsidiary.)

The CAD system has been designed for a person who knows how to put a circuit together, without knowing anything about how to design an IC. Everything is expressed in ordinary TTL circuit terms with which an engineer or technician would be familiar. In fact, the cells have standard 74xx numbers.

One interesting feature of the CAD system is that it allows complete circuit emulation. According to TI spokesman, Ron Jukov, it is possible to specify the inputs (either static or dynamic), and then observe the outputs. The software is especially detailed so that it knows all the parameters

of the processes used by TI, such as access time and propagation delay. As a result very accurate emulation of the outputs is possible.

The effect of the new technologies is being felt by smaller manufacturers as well. Increasing automation of assembly lines is making the process cheaper, by doing away with labour. At the same time increasing integration and SMD are making for smaller and less costly boards.

At General Power Controls, located in Penrith, west of Sydney, managing director Fred Morris has just finished evaluating an SMD addition to his flourishing board 'stuffing' operation.

According to Morris SMD is currently 20% more expensive than conventional DIP assembly. Thus one would expect it to be used only where the application would justify the additional expense. He predicts SMD and DIP procedures will continue in parallel for a long time.

In fact, it appears that there is quite a role emerging for SMD devices in ordinary circuit board assembly. They are particularly amenable to mounting on the underside of the board, with the possibility of tremendous space savings in board real estate.

Costs

The exact amount that a circuit will cost to manufacture depends on a whole host of imponderables, such as the complexity of the circuit and how well the designer does his homework. But it is possible to get some ball park figures that illustrate trends.

For instance, a TI spokesman said that assuming a requirement for 10,000 units,

which might be the production run for a typical Australian manufacturer, GAs with 200 gates would cost about \$1.40 each. Up that to 700 gates and the price increases to about \$4. Development costs for such a GA would probably be of the order of \$10,000.

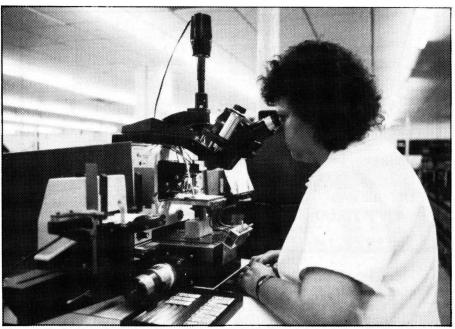
To do the same job on standard cells would cost about \$15,000. Price would depend strongly on the number of units ordered, but they would be cheaper than GAs in quantities above 1000.

At Plessey, John Nicol wasn't prepared to commit himself to dollars and cents, but expressed the same problem in an equally useful way. According to Nichols, if you have a production run of between 1000 and 10,000 units, gate arrays are relevant. Up that to less than 100,000 units and custom cell technologies apply. Over 100,000 and fully customized chips are worth looking at.

Depending on the application the MPC can also be a very attractive choice. It costs as much to do as a fully customized chip, but its cost is spread among the various users. So the implication is that if you can count on 100,000 units between, say, five or six users, that is 20,000 each, the MPC can be economically attractive.

Hybrids don't fit neatly into this picture because they are sometimes preferable on non-economic grounds. For instance, inductors can't be integrated, and thus demand a hybrid. Another problem can be power. The typical hybrid can dissipate more than an IC.

They start to become economic in units of a few hundred, and for large scale production, say in the order of tens of thousands, they are rapidly becoming indispensible.



Through the looking glass. The silicon chip is connected to the substrate via fine wire lines. These are held, positioned and glued by the micro-manipulators she is controlling.

• 4½ digits • 8 functions Vdc, Vac, Adc, Aac, Ohms, Audible Continuity, Diode test, Data Hold • 0.05% basic dc accuracy



FOR CHIPS

WOOD

WOOD FOR CHIPS

CHIPS

WOOD FOR

WOOD FOR CHIPS

WOOD FUR CHIPS.

CHIPS

FOR

MOOD

FOR CHIPS

... WOOD

WOOD FOR CHIPS.

CHIPS

FOR (

MOOD

DC Voltage Range Resolution 200mV 2V 20V 200V 1000V 10uV, 100uV, 1mV, 10mV, 100mV
 200mV - 1000V ± (0.05%rdg + 3dgt) Accuracy AC Voltage: (True RMS, AC coupled 10% to 100% of range) 200mV, 2V, 20V, 200V, 750V Range 10uV, 100uV, 1mV, 10mV, 100mV 200mV - 200V (a45Hz-1KHz ± (0.5%rdg + 20dgt) Accuracy @1KHz - 2KHz ± (1.2%rdg + 200gt) @2KHz - 5KHz ± (5.0%rdg + 40dgt) (200V @2KHz - 5KHz not specified 750V @45Hz - 1KHz ± (1.0%rdg + 20dgt)

DC Current

• 2mA, 20mA, 200mA, 2A, 10A • 100nA, 1uA, 10uA, 100uA, 1mA Range Resolution Accuracy 2mA – 200mA ± (0.3%rdg + 3dgt)
 2A-10A ± (0.75%rdg + 3dgt)

AC Current: (True RMS, AC coupled 10% to 100% of range)

Range Resolution Accuracy • 2mA, 20mA, 200mA, 2A, 10A • 100nA, 1uA, 10uA, 100uA, 1mA 2mA @45Hz - 400Hz ± (2.5%rdg + 20dgt) 20mA - 200mA @45Hz-400Hz ± (0.75%rdg + 20dgt)

@400Hz - 1KHz + (0.75%rdg + 30dgt) @45Hz - 500Hz ± (1.2%rdg + 20dgt)

Resistance

Range Resolution Accuracy 200 Ω, 2ΚΩ, 20ΚΩ, 200ΚΩ, 2ΜΩ, 20ΜΩ • 0.01Ω , 0.1Ω , 1Ω , 10Ω , 100Ω ; $1K\Omega$ • 200Ω \pm $(0.2\% rdg + 5dgt + 0.04\Omega)$

 $2K\Omega - 200K\Omega + (0.1\%rdg + 3dgt)$ (0.15%rdg + 3dgt)

\$258.75 inc. tax.

EDM 1346 only

AND A 3½ DIGIT SIX **FUNCTION DMM FOR** ONLY \$75.00

ex tax

- 31/2 digit 6 functions Vdc, Vac, Adc, Ohms, Diode test
- 0.8% basic dc accuracy



EDM1105 only ex tax

DC Voltage		
Range	 200mV, 2V, 20V, 200V, 1000V 	
Resolution	 100uV, 1mV, 10mV, 100mV, 1V 	
Accuracy	 200mV – 1000V ± (0.8%rdg + 1dgt) 	
AC Voltage		
Range	 200mV, 2V, 20V, 200V, 750V 	
Resolution	 100uV, 1mV, 10mV, 100mV, 1V 	
Accuracy	 200mV – 750V 	
	@45Hz-500Hz ± (1.5%rdg + 4dgt)	
DC Current		
Range	 2mA, 20mA, 200mA, 2A, 10A 	
Resolution	 1uA, 10uA, 100uA, 1mA, 10mA 	
Accuracy	 2mA - 200mA + (1.25%rdg + 1dgt) 	
	2A-10A + (2.5%rdg + 3dgt)	

Range Resolution Accuracy

20mA - 200mA @45Hz - 400Hz ± (2.0%rdg + 3dgt) 2A - 10A @45Hz - 400Hz ± (3.0%rdg + 4dgt)

Resistance Range Resolution

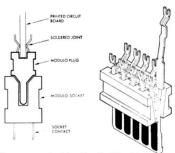
, 1Ω , 10Ω , 100Ω , $1K\Omega$, $10K\Omega$ $\pm (1.0\% \text{rdg} + 4\text{dgt})$ Accuracy -2MΩ ± (1.0%rdg + 1dgt) 20MΩ ± (3.0%rdg + 5dgt)

 2mA 20mA 200mA 2A 10A • 1uA, 10uA, 100uA, 1mA, 10mA • 2mA @45Hz — 400Hz ± (4.0%rdg + 2dgt) 200Ω . 2KΩ . 20KΩ . 200KΩ . 2MΩ . 20MΩ WHY PAY MORE FOR CENTRONICS CONNECTORS?

Gold plated contact. 36 way. Solder eyelet Metal shell. Save, our plugs are ONLY \$8.50, Sockets \$7.75!!



MODULAR P.C. EDGE CONNECTORS & PLUGS



We are now stocking the double sided Modulo 100 Plug which is ideal for adding an edge connector plug to pcbs. Saves cost of gold plated fingers on pcbs. We supply cut to size with 10+10 to 85+85 contacts. Moulded in glass-filled DAP with gold plated solder contacts. Fits standard double sided pcb. 0.1" pitch. 500V, 5A rating.

Matching modular edge connectors on 0.1" pitch. Double sided. Choice of terminations mini-wrap, Dip solder, solder eyelet. Contact us for prices.

LORLIN SWITCHES

Inexpensive single wafer rotary switches of moulded construction. Adjustable stop. Av ailable in 1 pole/12 way, 2 pole/ 6 way, 3 pole/4 way, 4 pole/3 way



HIGH CAPACITANCE ELECTROLTICS EYF Electrolytics, Polarized.

switchproof, radial version

2200uF	63V	25mm(D)	27mm(H)	\$3.70
3300	50	30	30	\$3.85
4700	50	35	30	\$5.54
6800	25	30	30	\$3.85
6800	35	35	30	\$5.54
10000	25	35	30	\$5.54
15000	16	35	30	\$5.54

8.30 to 5 Monday to Friday. 8.30 to 12 Sat. Mail Orders add \$3.00 to cover postal charges. Next day delivery in Sydney add \$5.00.

Tax exemption certificates accepted if line value exceeds \$10.00.



GEOFF WOOD ELECTRONICS PTY LTD

Incorporated in N.S.W. 656A Darling St, Rozelle 2039 (One door from National Street)

8106845



specialising in electronic components for the professional and hobbyist.

WOOD FOR CHIPS

WOOD FOR

CHIPS

MOOD

50000 hr. Will

One style: fully loaded One price: \$1665* One source: Hewlett-Packard

tion budget is not for you, the HP 3478A should prove ideal for your bench or system automatic measurements. For only \$1665* you get a fully loaded six function DMM with HP-IB-not just a starter unit you have to pay later to upgrade.



All the right features plus HP-IB.

You can measure dc volts, RMS ac volts, dc current, RMS ac current, and 2- and 4-wire ohms. Plus, the HP 3478A is a fully programmable HP-IB system instrument. You have the convenience of switchable front/rear terminals, scanner advance, and external trigger input. You can even automate the HP 3478A's builtin electronic "no pots" calibration.

Costs less to own.

When it comes to reliability, the HP 3478A is one of the best.Our field-proven reliability figures indicate over 50,000 hr MTBF (equal to 25 operational years).** So intensive is our attention to quality, from design right through production, that once you install your HP 3478A chances are you won't have to repair it or worry about it for the life of your system.

Call HP today.

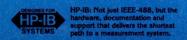
For full details on the cost-cutting reliability leader HP 3478A DMM, ring your nearest HP office listed: Melbourne: 895 2895; Adelaide: 272 5911; Perth: 383 2188; Brisbane: 304133; Canberra: 804244; Sydney: 8884444; Auckland: 687159. **For 2,000-hour years, based on warranty data and other

System DMMs...HP's the right decision



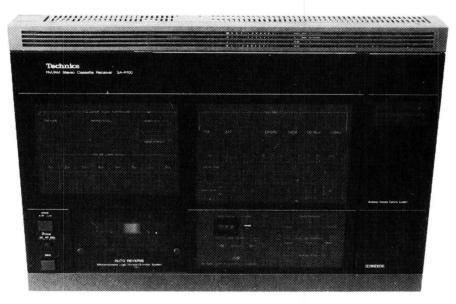
HEWLETT PACKARD

eo Burnett 7123 HEP 90455





'STEREO NOUVEAU' TO HANG AMONG **YOUR NOLANS**



Technics has come up with a hi-fi system which is different: an AM/FM stereo receiver, cassette player, and amplifier that hangs on your wall and has inputs for your other equipment! The SA-R100 is not only neat, it gives quality performance at an accessible price.

TECHNICS SA-R100 RADIO/CASSETTE

Dimensions:

460 mm (wide) x 315 mm (high) x 65 mm (deep)

Weight: Manufacturer:

Matsushita Electric Trading

Co. Ltd, Osaka Japan \$1,350 (excluding speakers) FOR ALMOST 50 years consumers have been forced to accept the shapes, sizes and often unacceptable concepts forced on them by the electronics industry. Nowhere has this been more evident than in the field of wooden boxes, silver boxes and more recently black boxes which contain the individual pieces of high fidelity equipment you will find in your local hi-fi shop. If you are satisfied with stacks of equipment, racks of equipment or other configurations and layouts on the tops of your sideboards which I generally find equally restrictive, then the contents of this review will not prove to be as exciting as I found it to be.

Spurning convention!

The trouble with all these 'conventional' systems is that they presume that you have the space, the furniture and the layout which is appropriate for hi-fidelity but standard sized equipment. However, in most houses in which I have been consulted, or in which I have been a private guest, the existing room layout normally conflicts with the optimum layout for hi-fi equipment.

Technics has seen a way to overcome this problem with an extremely natty and ingenious concept that I guess everybody else will start copying next year. That is to attach the whole hi-fi system (console and speakers) to a wall (preferably the most convenient wall) without the need of any furniture. To make the system more 'user friendly' the package contains an integral infrared remote control unit which provides the most important controls from any chair within the room or even from your bed.

To make the system really work, Technics has supplemented this design concept with an exciting new set of speakers which are only 65 mm deep and which provide an unbelievably good performance for their

Absolute copyright in this review and accompanying measurements is owned by Electronics Today International. Under no circumstances may any review or part thereof be reprinted or incorporated in any reprint or used in any advertising or promotion without the express written agreement of the Managing Editor.



Louis Challis

In the ETI workplace. The SA-R100 radio/cassette can be either hung on the wall like the speakers or placed elsewhere using its supporting stand.

miniscule size.

The SA-R100 incorporates an AM/FM stereo receiver, a bi-directional cassette recorder, a power amplifier and inputs for record player, video, CD player and auxiliary inputs all within one neat and attractive flat package. Although capable of using all of these other inputs, the unit will achieve its greatest potential when these other inputs are not used.

The appearance of the unit is remarkably attractive, with the front panel divided into six primary areas. At the top left hand corner is the quartz controlled receiver section which indicates whether FM or AM has been selected, as well as the frequency (to a five digit resolution), the signal strength and whether the quartz phase-locked loop circuit is activated. It also indicates which of the eight FM or eight AM preset channels has been selected. Immediately below this display are the power ON/OFF switch, the external timer input and the eject button for the auto reverse cassette recorder, which is located immediately to the right.

The cassette recorder incorporates two motors and a bi-directional capstan drive system. All controls, other than the selection of recording levels and Dolby noise reduction, are provided by means of the remote control transmitter (either when inserted in its internal well, or when located remote from the unit).

In the upper central section of the front panel is the input selection display, which provides six amber light emitting diodes to indicate whether FM, AM, PHONO, TAPE, CD/AUX or VIDEO has been selected. Immediately below this is a ten level amber display to indicate the setting of the digitally controlled externally selected volume control level. This particular display is very important particularly when you are switching from one input to another, as I subsequently discovered.

The third level of the input selector display is the digital peak level indicator covering the range -30 to +8 dB, which neatly displays the incoming signal level (irrespective of the source) and with sufficient number of diodes in each section to be readily visible from almost any point within a room.

In the lower central section of the front panel is a three digit tape counter with reset button and a Tape Programme Selector red indicator light. Immediately below these displays are green arrows to indicate forward and reverse direction of tape travel, a green PLAY display light, a red RECORD light and an amber PAUSE light. The TPS function provides a convenient means of searching the next number by pressing the FAST FORWARD button when in the PLAY mode so that the recorder automatically searches for the next recorded track.

On the right hand side of the lower section of the central display are the indicator lights for Dolby B or Dolby C and the auto tape selector, which indicates whether normal gamma ferric oxide, chromium dioxide or metal tapes have been automatically selected and correctly detected by the internal electronics. Below this is the display which indicates whether normal single direction play has been selected, single pass reverse play, or multiple continuous reverse play.

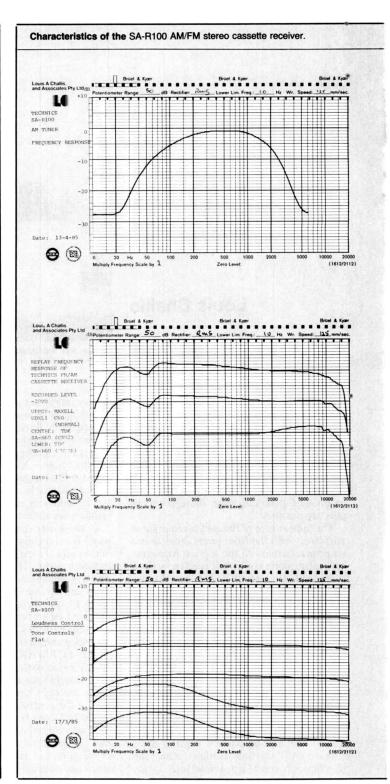
On the extreme right hand side of the front panel is a vertically hinged cover behind which all of the infrequently used controls are located. At the top are the eight AM/FM tuning controls. Immediately below these is the photo diode detector which receives the remote control signal when either used remotely, or when the remote control is tucked into its normal storage 'cubby hole' immediately below. The remote control provides buttons for the six input selector modes, eight station frequency pre-sets and full function controls for the cassette recorder. These controls also include a RECORD MUTE button and a REVERSE mode button by means of which the three separate modes are achieved by sequential pressing.

The volume (loudness) is controlled by two separate up/down switches and last but not least the remote control transmitter has an indispensible BATTERY CHECK light. With the remote control transmitter removed from its cubby hole, an additional group of supplementary controls is revealed on the panel immediately behind. These controls include a LOUDNESS on/off switch at the top, a set of BASS and TREBLE slider controls, a MICRO-PHONE mixing input control on the left, a BALANCE control on the right and a LEFT/RIGHT channel VOLUME control slider switch below.

At the very bottom right hand corner is a three position selectivity switch for the AM receiver, a pair of up/down tuning controls for setting the station frequencies, a Dolby Out, Dolby B or Dolby C switch. Next is a memory activation button, an FM mono or auto position and an FM frequency shift selector which provides 25 kHz steps to facilitate selection of FM stations which do not lie at the normal 50 kHz step frequency provided by the digital synthesizer.

On the left hand side of the unit are aerial terminals, behind a neat access cover. This is normally intended to be used with the internal FM dipole antenna provided, as well as with the ferrite loop-stick antenna which neatly clips onto the top of the unit and plugs into a miniature socket on the rear panel.

AMPLIFIER DATA SHEET TECHNICS FM/AM CASSETTE RECEIVER MEASURED PERFORMANCE OF: FA4L25B006 SERIAL NO: FREQUENCY RESPONSE (-3dB re I watt): Tone Controls Centred 16.0 Hz 27 kHz Left to 16.0 Hz 29 k Hz Right SENSITIVITY (for I watt in 8 Ohms): Left Right 23.2 mV 24.2 mV 0.3 mV 0.4 mV 115 mV 22.8 m CD Auxiliary Video 22.5 mV 0.3 mV Microphone Phono m/m Phono m/m 0.4 mV 112 mV OVERLOAD INPUT IMPEDANCE (@ IkHz): Left Right 33 k ohms 33 k ohms CD Auxiliary Video 33 k ohms 33 k ohms Microphone 10 k ohms 10 k ohms Phono m/m 47 k ohms 47 k ohms OUTPUT IMPEDANCE (@ 1kHz): 185 milliohms NOISE & HUM LEVELS (re I watt in 8 ohms): 77.0 dl\(A) 72.5 dB(Lin) Input 0.5 V CD Auxiliary Input 5 mV Phono m/m 71.5 dB(Lin) 76.0 dB(A) HARMONIC DISTORTION: AT RATED POWER OF 1.0 WATTS INTO 8 OHMS 100Hz 6.3kHz IkHz -87.3 -84.1 -82.1 -93.1 -83.2 -86.3 4th 5th -103.1 -99.4 -94.2 0.006% 0.014% -84.3 -77.2 AT RATED POWER OF 28.0 WATTS INTO 8.0 OHMS 100Hz lkHz 6.3kHz 2nd 3rd 4th 5th -79.3 -85.9 -74.1 -73.3 -113.5 -83.1 -72.4 -76.4 -96.1 -96.2 0.009% 0.034% IEC HIGH FREQUENCY TOTAL DIFFERENCE FREQUENCY DISTORTION 8 kHz and 11.95 kHz mixed 1.1 At rated power At I watt MAXIMUM OUTPUT POWER AT CLIPPING POINT (IHF-A-202): 50.2 V p-p 39.4 watts 1.5 dB (20 mS burst repeated at 500 mS intervals) ... Dynamic Headroom re 28 watts



On the right hand side of the unit is a hinged panel with a HEADPHONE socket, MICROPHONE socket, PHONO synchronization cable intended to be used for automatic recording with Technics turntables, and RCA sockets for recorder out, CD or AUXILIARY, VIDEO, PHONO, and last but not least, a screwed ground terminal.

On the back of the unit are two pairs of colour coded speaker lead sockets for one set of speakers into which bared leads are inserted and the terminals rotated to retain the wire. The unit also comes with a detached pair of chrome plated tubular steel, rear mounted supporting brackets (legs) for positioning the unit with its front sloping on top of desk or shelf or sideboard. It also comes with complete hardware for screwing the unit on the wall.

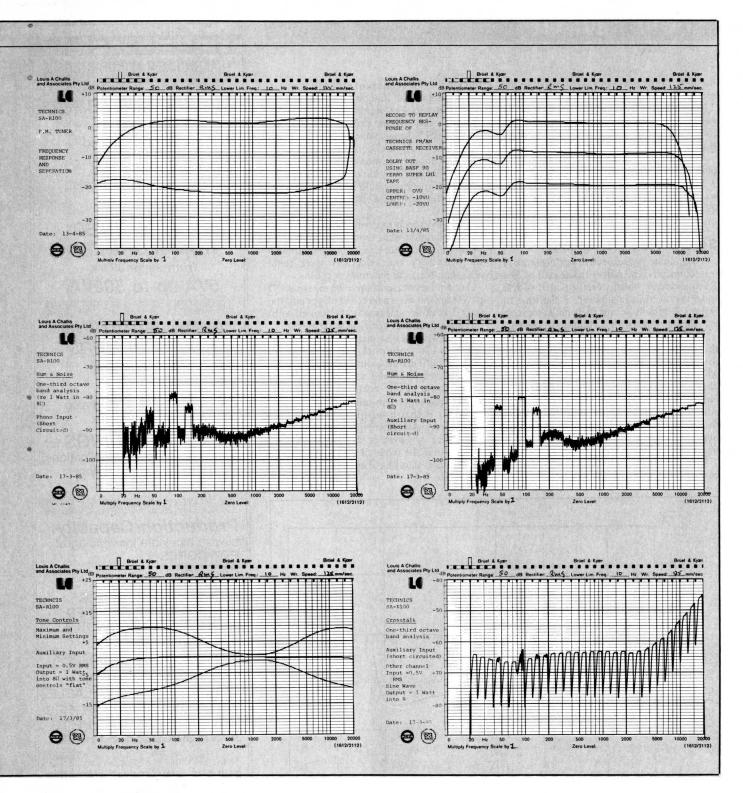
Specs

Date: 13th April 1985

All of this is provided in what is an unu-

sually small package with a pair of power amplifiers rated at 28 watts per channel into 8 ohms.

The unit is designed for vertical mounting with a very effectively designed thermal dissipation circuit which places the power output stage at the very top of the panel. The power output stage is a vapour phase-finned heat tube system. All of the other electronics is neatly mounted on well interconnected and wired printed circuit boards.



The objective performance of the unit was surprising considering the section of the market for which this unit has been designed. The amplifier produces a frequency response of 16 Hz to 27 kHz at the -3 dB points and a power output of 28 watts with both channels driven for distortion levels of less than 0.4%. The IEC total difference frequency distortion measurements reveal that the distortion at maximum output is only 0.0072%, which is really excellent.

The tone controls provide 10 dB of boost and cut at 50 Hz, and 9 dB of boost and 8 dB of cut at 10 kHz.

The phono input signal-to-noise performance is an excellent 80 dB(A) relative to 0 VU, the auxiliary signal-to-noise input is 77 dB(A) relative to 0 VU. The interchannel crosstalk is better than 63 dB at frequencies up to 3.5 kHz, drooping to a figure of 45 dB at 20 kHz. The loudness controls really do work and provide a reasonable

duplication of the equal loudness contours of the human ear.

Overall, the amplifier's performance is particularly good and more than good enough for the above average hi-fi enthusiast.

The tuner response is particularly good with only 0.9 micro volts of signal required for 26 dB signal-to-noise ratio the frequency response is flat from 20 Hz to 15 kHz within ± 1.5 dB. The AM tuner, al-▶

SOUND REVIEW

though offering adequate sensitivity and reasonable selectivity, still provides only a 2 kHz bandwidth at the 6 dB point, which is neither high fidelity, nor really adequate for mono reception let alone stereo AM reception which is now received in Australia.

The cassette player performance on replay is particularly good with an effective +2 to 4 dB frequency response from 18 Hz to 16 kHz with gamma ferric oxide tape and 22 Hz to 16 kHz record to replay response on gamma ferric oxide tape.

Subjective performance

To evaluate the subjective performance, I interconnected the unit with the pair of SB-R100 speakers which were provided with it (also reviewed in this issue), at the time of testing. I initially set up the total system on a bedroom wall (with a volume of 30 m³).

The most important initial response was the clarity of the audible signal with both the intended speakers and subsequently with alternative speakers. The cassette player in particular provides a quality of signal with power outputs which are unexpectedly loud in a small bedroom. Repeating the exercise in a larger room (with a volume of more than 250 m³) did not really change my subjective impression.

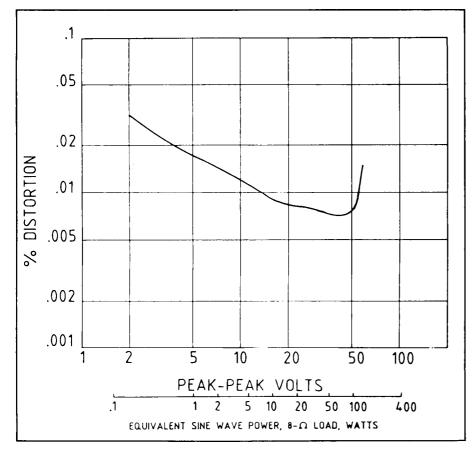
The basic unit has the capacity to deliver considerable low frequency power even

though the intended speakers are not specifically designed for that purpose. The quality of the stereo FM signal is excellent and nearly as good as that provided by the Sansui model TX tuner, which I used for intercomparison. The frequency selection capabilities with eight station pre-sets meets my current FM and AM station requirements to a 'T' and I believe would prove adequate in any Australian capital city at this point of time.

The AM reception, while almost acceptable, exhibited the time honoured complaint of inadequate bandwidth even though the sensitivity and selectivity were quite adequate for local listening purposes.

I connected the unit up to an external CD player and an external record player and the overall audible quality was maintained without any significant criticism whatsoever.

The unit offers so many attractive ergonomic design features that it seems hard to believe that Technics could provide so many desirable features and with such excellent performance in one neat, compact and attractive package. This unit has just so much going for it that it ought to out-sell all its competitors almost irrespective of its price. That price however is still sufficiently attractive to make it one of the most desirable hi-fi systems that I have evaluated in the last few years.



TELECTRAN

TRANSFORMER MANUFACTURERS

POWER TRANSFORMERS

1VA up to 100VA fitted with pins for printed circuit board mounting. 150VA to 250VA with screw or QC terminals.

Full range of FLAT MOUNTED TRANSFORMERS from as small as 5VA up to 500VA.

AUDIO MATCHING TRANSFORMERS 100V line to low impedance.

Printed Board Mounting also Screw or Tag Terminals

TOROID WINDINGS for

Filters or Switching Applications. High Production of Custom Designs.

Production Capacity: always available for winding of

POT CORES RM CORES EP CORES

EE, E and U or L CORES FERRITE AND POWDERED IRON TOROID WINDINGS A SPECIALITY.

FULL RANGE OF STOCK TRANSFORMERS AVAILABLE MANUFACTURING FACILITIES FOR TRANSFORMERS UP TO 35KVA SINGLE OR 3 PHASE.

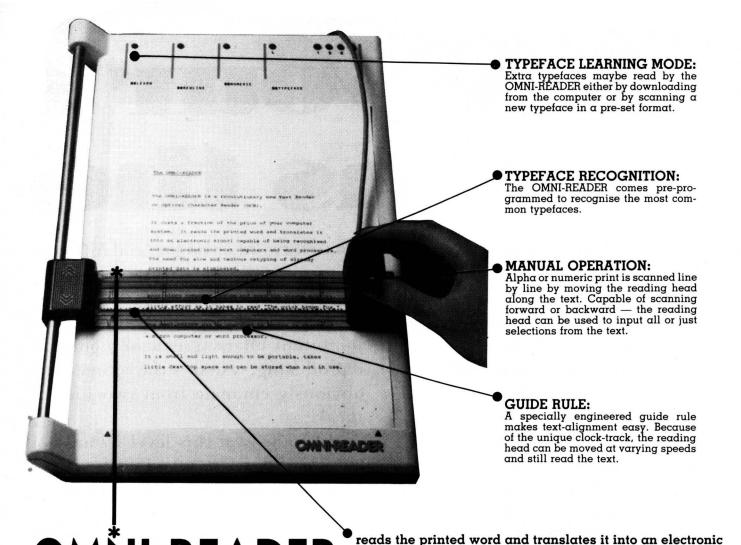
PLEASE WRITE FOR DETAILS

TELECTRAN

59c MYOORA RD., TERREY HILLS. 2034 N.S.W.

OR PHONE (02) 450-2868 (02) 450-2395

Robert Ford & Co. Pty Ltd



Audio Engineers announce a revolution in taking words from page to your computer

Speed-reading & input of printed materials for:

- Word Processor Input
- Entering Electronic-Mail Text

OMNI-READER

 Storing/Editing documents for Electronic Filing. Transferring text between incompatible computers or WP's without re-typing.

signal capable of being recognised and down-loaded into

most computers or word processors.

 Input datatables or new data into Spreadsheet/dataBase programs.

OMNI-READER attaches through a Serial RS232 interface as easily as a modem. EXCLUSIVE TO

Audio Engineers Call (02) 29-6731 to arrange a demonstration 342 Kent St., Sydney 2000 or in W.A. call (09) 361-5954

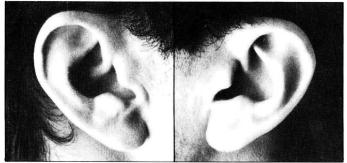
Are your easthe

"The CD-44 is most probably the 'sharpest' and most marketable CD player introduced by the Marantz company. Its major attributes extend beyond the realm of price as the designers have aimed at providing a sophisticated performance which does not appear to be limited by price.

The frequency accuracy of the player proved to be outstanding. The consequent frequency deviation was only a paltry 0.1Hz for the 20kHz reference signal. The frequency linearity was 20Hz to 20kHz ± 2dB. That sort of accuracy is not likely to be improved upon by any other player.

This sort of performance would be raved about by other manufacturers and their P.R. personnel as state of the art performance."

Louis Challis. "Electronics Today International". May 1985.



STAN CURTIS' RIGHT EAR.

STAN CURTIS' LEFT EAR.

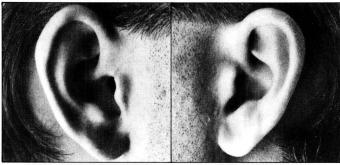
"By contrast, the Marantz player produced a sound which was smoother,

not so forward or bright, and infinitely more musically convincing.

Many recordings played on the Marantz exhibited that very important characteristic of a good reproducing system – the sound didn't obviously emanate from two loudspeakers.

Obviously at this level we are not talking about a standard of reproduction that was poor, but of a difference in absolute performance which made the Marantz preferable."

Stan Curtis. "Hi-Fi for Pleasure."



DAVID PRAKEL'S RIGHT EAR.

DAVID PRAKEL'S LEFT EAR.

"I have been surprised by the quite audible difference between CD players and have already stated a preference for the sound of the Marantz machine in terms of its handling of "ambience" and its sheer unfatiguing listenability.

Other players I've heard in direct comparisons have shown a bright veiling effect with more up-front presentation and a fatiguing quality.

ars as good experts?

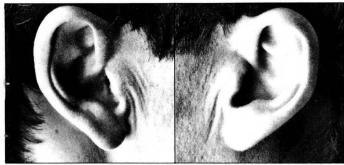
How much of this is down to the quality of the analogue audio circuitry in the players in question, and how much to the 14 versus 16 bit systems, I'd hate to guess."

DavidPrakel. "Hi-FiAnswers," U.K. "Ironically, after all the opulent, lavish and wholly enjoyable CD launches of the past four years, it was in these very low key surroundings that I can truly say I first heard the potential of this system.

To my ears and those of our Technical Editor, Dave Berriman, it was the most convincing and encouraging demonstration to date.

But why should little Marantz get it right where the others have failed? It certainly encouraged many who had come to despair of CD ever attaining the heights claimed for it."

DavidPrakel. "PracticalHi-Fi," U.K.



MARTIN COLLOMS RIGHT EAR.

MARTIN COLLOMS LEFT EAR.

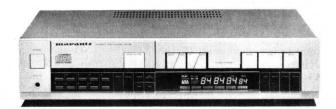
"Marantz U.K. managed to lend me a CD player for just a few hours. To my ears and in my system the CD player provided a standard of home replay as good as I have ever used.

It was found that during the sessions the sound level was very high, in fact to the limit of the system, and yet the sound itself did not appear loud.

This is a very good sign, a feature familiar to me from my collection of copy master tapes. Moreover, in certain respects, the sample programme bettered my master tapes.

Judging from the advance sample, the Marantz CD has a very bright future."

Martin Colloms. "Hi-Fi for Pleasure," U.K.



For further information contact: Marantz (Australia) Pty. Limited. Incorporated in NSW. 19 Chard Road, Brookvale, NSW, 2100.

Telephone (O2) 939 1900 or your nearest Marantz dealer.

marantz

MORE TRICKS FROM TECHNICS

— wall-mounting speakers

A speaker system to go with the compact SA-R100 radio/cassette unit, the Technics SB-R100s perform remarkably. Hanging on the wall they permit a flexibility in positioning and saving of space that could even do away with the notorious stereo enhancer!

Louis Challis

THE SB-R100 COAXIAL HONEYCOMB disc speaker system is one of the smallest, if not flattest, speaker systems available in the world. The reason (raison d'etre) underlying its design was to provide a wall-mounted speaker which would match the characteristics of the SA-R100 AM/FM stereo cassette recorder system. What resulted from the development was considerably better than the marketing personnel and design engineers originally envisaged.

I have been aware of the SB-R100s since I first read their description in a Newsweek 'new product' technical release late in 1983. In the long period that followed, I unsuccessfully attempted to obtain a pair for review purposes. During that period however, I reviewed other Technics speakers, like the SB5s, which gave excellent performances and only increased my desire to evaluate the SB-R100s.

When these speakers finally arrived, they were accompanied by the SA-R100 system which was equally interesting and so a double review resulted.

A unique speaker

The SB-F.100 has been based on a 'tried and true' concept of a dual concentric loudspeaker system. Thereafter any similarity between this speaker system and any other speaker system with which you may desire to compare it becomes highly questionable.

The central tweeter in this system uses a honeycomb element with a diameter of 30 mm. This has a protective diaphragm that looks for all the world like a diaphragm

from a Bruel & Kjaer laboratory microphone. The reasons for this are not too hard to find, as the Technics speaker development laboratory in Osaka is well equipped with Bruel & Kjaer microphones which form the backbone of their measurement systems.

This choice of configuration is well conceived as it does provide maximum sound dispersion at high frequencies. Around the outside of the tweeter is a concentric annular woofer with inner and outer rolled flexible terminations. This provides a remarkably flexible diaphragm system, with generally low resonance characteristics in the normal operating range. It is supported on an annular basket structure which is shown more clearly in the attached cross section (Figure 1). Surrounding the woofer is yet another annular diaphragm with its own flexible surround. This incorporates the passive radiator structure which boosts the low frequency peformance of the basic two-way speaker system.

The total coaxial structure is supported in a remarkably rigid ribbed diecast box structure which contains integral screw fixings supported on the stiffening ribs. The edge structure is designed to support the perforated black finished front cover as well as contain all the optional fixings for the supporting brackets and wall brackets. This unit also incorporates a self-powered protection circuit to prevent the destruction of speakers.

The diameter of the woofer is a modest 160 mm which is not much bigger than most mid-range speakers, while the diameter of

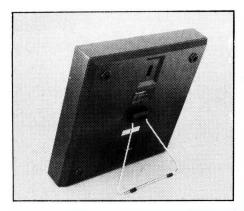
the tweeter diaphragm is only 35 mm. The passive radiator has an external diameter of 230 mm and this leaves considerable space beyond its surround for the speaker cabinet damping material, which forms an integral part of the total speaker system design.

The tweeter has a voice coil diameter of only 19 mm. The woofer voice coil diameter is a massive 100 mm. With a voice coil diameter as large as this and a very rigid structure provided by the honeycomb speaker diaphragm, low-frequency resonance problems ought to be minimal. This is exactly what happens. The cabinet stiffness derived from this unusual configuration as well as the small dimensions provide the opportunity to achieve technical performance characteristics which are not only unusual but also impressively good.

The speakers are supplied with an unusual flat ribbon cable which is brown on one side and light fawn on the other. This is suitable to fix to the wall or lay behind your furniture.

Objective performance

The performance evaluation of this speaker system in our anechoic room was done without a backing wall. This revealed that the frequency performance over the range of 100 Hz to 20 kHz is positively outstanding: a frequency variation with less than ± 5 dB from 100 Hz to 20 kHz on axis and still within ± 6 dB at 30° to the main axis. These measured responses would be better with a backing wall behind the speakers; the wall would then extend the lower end of the frequency response down to a fig-



TECHNICS SB-R100 SPEAKER SYSTEM

Dimensions: 315

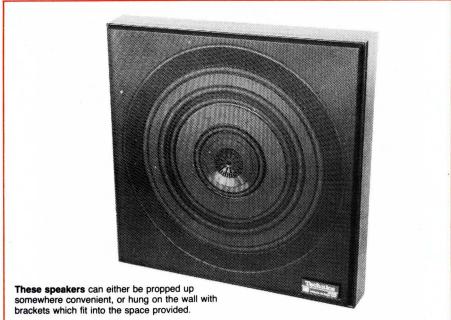
315 mm (wide) x 315 mm (high) x 65 mm (deep) 4.5 kg (each)

Weight: Manufacturer:

Matsushita Electric Trading Co. Ltd., Osaka Japan

RRP:

\$440 (per pair)



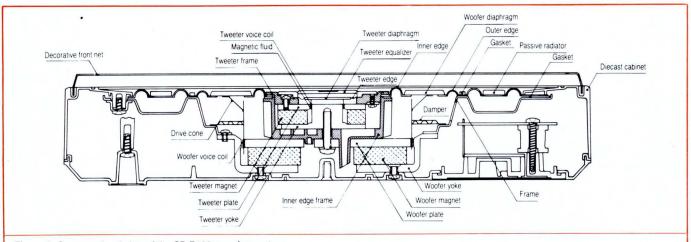


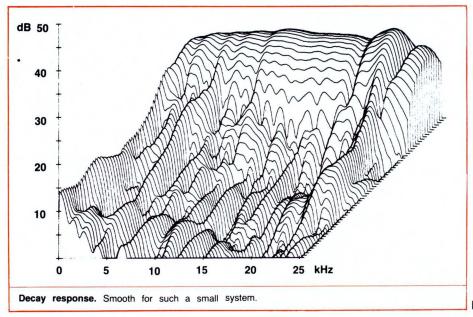
Figure 1. Cross-sectional view of the SB-R100 speaker system.

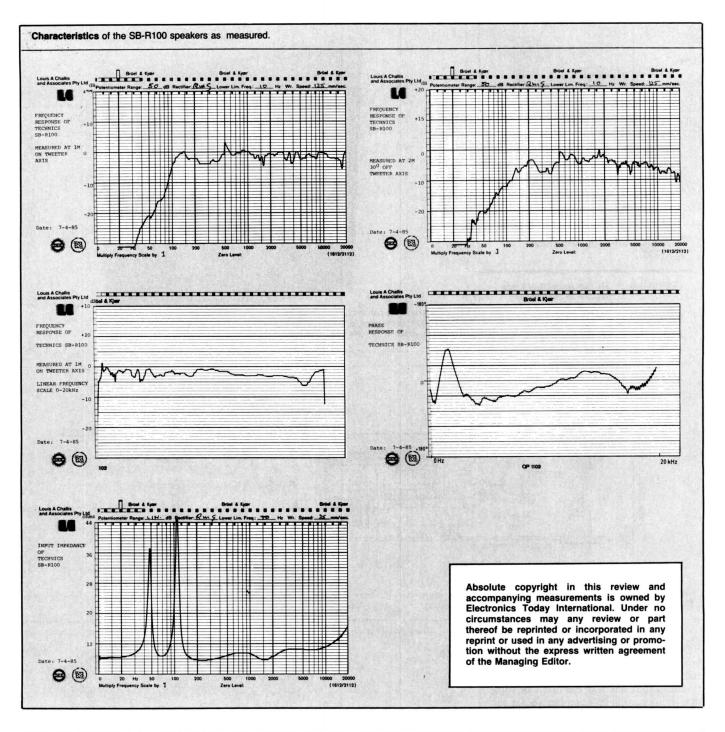
ure of approximately 80 Hz.

One inexplicable characteristic observed on the level recordings was the sharp change in response observable at 500 Hz. I presumed that this was the result of some form of interaction between the woofer and the tweeter but couldn't actually confirm this as the cross-over is supposedly 2 kHz. Both speakers exhibited the same problem and this also showed up in the decay response spectra.

The impact of the design configuration on the impedance curve is rather interesting and the unit displays two prominent fundamental resonances at 48 Hz and 110 Hz respectively. These have relative sharp 'Qs' and particularly high impedances. The lowest impedance of the SB-R100 is only 8 ohms and consequently it is possible to parallel two pairs of the same type or a pair of these with other speakers without necessarily introducing serious impedance problems.

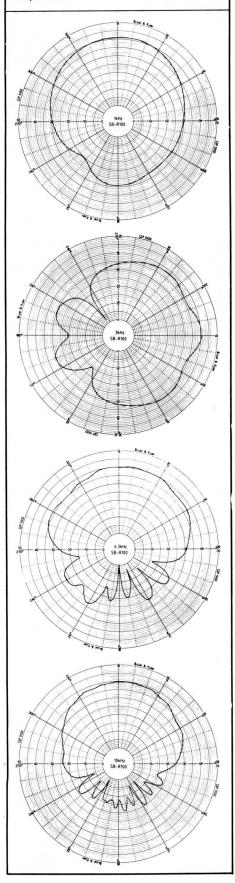
The phase response of the speakers



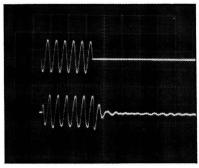


	LOUD	SPEAKER DATA SHEET					
MEASURED PERFORMANCE OF	TECHNICS SB-R100	HARMONIC DISTORTION:		100Hz	IkHz	6.3kHz	
SERIAL NO:	BB4817A163		2nd	-32.9	-49.7	50.0	-in
FREQUENCY RESPONSE:	90 Hz to 20 kHz +		3rd 4th	-35.3	-43.4 -65.3	-58.0 -56.3 -69.8	dB dB dB
CROSSOVER FREQUENCY:	2 kHz		5th THD	-54.3 2.8	-64.1 0.75	0.20	dB %
SENSITIVITY:		INPUT IMPEDANCE ONE TEST:		1001	Hz/7kHz 4	:1	
			100Hz		24.0	ohms	
(for 96 dB average at 1m)	10.1 V r.m.s. = 12.75 Watts (nominal into	8 Ohms)	lkHz		9.4	ohms	
			6.3kHz	m at 250 Hz	7.6	ohms	
Date: 7th April 1985				m at 120 Hz		ohms	

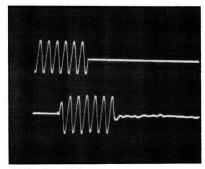
Polar response outstanding plots. An performance is marred by asymmetry at low frequencies.



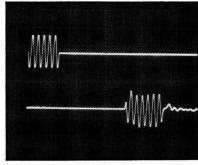
Tone burst response of the Technics SB-R100 for 90 dB steady state SPL at 1 m on axis. Upper trace is electrical input; lower trace is loudspeaker output.



100 Hz (20 ms/div)



1 kHz (2 ms/div)



6.3 kHz (0.5 ms/div)

proved to be remarkably smooth and indicative of the extremely stable performance and almost complete lack of interaction between the tweeter diaphragm and the woofer diaphragm. The tone burst spectra reveal a reasonably stable performance at 100 Hz, excellent performance at 1 kHz and some traces of carryover in the tail of the response at 6.3 kHz.

Surprisingly, the polar plots reveal an unexpected minor degree of asymmetry at all frequencies, with a low asymmetry at 1 kHz, a slightly greater degree at 3 kHz and a most significant asymmetry at 6.3 kHz. The bandwidth at 6.3 kHz and 10 kHz is remarkably smooth all the way out to ±30° to the main axis. The response band is within 3 decibels of 90° at 6.3 kHz and more than 60° at 10 kHz. This is quite an outstanding performance and is considerably better than that provided by many

SOUND REVIEW

rice. CARINA speakers costing four times the trice.

The distortion characters of the speaker are good to excellent at all frequent cies above 110 Hz. Only when freque come close to 100 Hz and particularly at lower frequencies does the distortion characteristic become significant. This is a result of the interaction of the high impedances, speaker diaphragm resonances and extremely small volume of the cabinet. With an output of 96 dB at 1 m, this distortion is still only 2.8% which is still just acceptable. At lower frequencies the distortion is much higher and generally unacceptable. The droop in output is so great however, that these distortion products are almost inaudible in the most 'real' signal content.

The decay response spectra reveal that, with the exception of a very measurable resonance at 3 kHz, and a further significant resonance at 20 kHz, the overall characteristics are reasonably smooth and far better than one could reasonably expect from a loudspeaker system which is so small (although admittedly not inexpensive).

Subjective performance

The subjective impressions I acquired listening to these speakers was that they are good, and in many respects memorable. With classical music, the performance is a little crisp, generally clean and normally uncoloured. When listening to the spoken voice or singing, the fidelity is particularly good. However, when listening to most popular music with significant low frequency output, the low frequency response is particularly modest and not unlike that provided by the original Quad Electrostatics speaker system against which I performed a direct A/B type comparison.

On rock music with considerable low frequency content, the performance was less than satisfactory particularly at a listening level in excess of 96 dB where frequency doubling and significant second and nasty third order distortion soon become very evident.

The SB-R100s are not everybody's 'cup of tea'. They are designed for people who have no space, no floor and maybe even no furniture. They are unquestionably the perfect bedroom speaker sytem, the perfect 'waiting room' speaker system and if they had a better low frequency response, they would almost be a perfect monitor system.

I like these speakers because of the things that they do better than other speakers, rather than being put off by those aspects of their performance in which they do not excel. As a matching system to the SA-R100 they are almost perfect and as a remote speaker system for an existing hi-fi, a kitchen speaker system, bathroom speaker system, patio speaker system or even child's room speaker system — they are almost unbeatable.

We've got the lot, at

COMPONENTS!



SIP RESISTORS

	1-9	10+
6 Pin	50¢	40¢
8 Pin	60¢	500
10 Pin	65¢	60¢



RELAYS e 3A connectors

SPDT	S14060	100+
\$1.20	\$1.10 S14061	\$0.90
\$1.50	\$1.40	\$1.20



50 K LOG POT

\$0.55



(RED BODY)

\$1.50	011000	\$1.40
DPDT Cat	S11052	•
\$1.95		\$1.75



DIP SWITCHES

1	1-9	10+
2 Way	\$1.50	\$1.10
4 Way	\$1.60	\$1 20
5 Way	\$1.70	\$1.30
7 Way	\$1.80	\$1 40
8 Way	\$1.90	\$1.50



RELAY AND BASE

Can carry 10A at 28V DC or 5A at 240V AC Supplies with Chassis Mounting Socket with screw terminals Great for school projects and demonstrations, switching DC power supplies, central circuits and with contacts parallel up to 20A can Normally \$8.95

NOW \$6.95



NEW JOINABLE PCB MOUNTING SCREW TERMINALS

ess than half the price of the old ones! Way 1-9 10+ 2 Way Cat. P10542 \$0.50 \$0.40

Cat P10543 \$0.75 \$0.65 (please note these are the new blue ones)



ENCLOSED ROTARY SWITCHES AT SPECIAL

10+
\$1.00



CRYSTALS SPECIALS

many in stoo 3.5795 MHz 14.318 MHz

18.00 MHz 20.0 MHz All \$2.50 each!

10 or more \$2 each!

CONNECTORS!



SOLDER CENTRONICS PLUGS

ce for absolute top quality charge up to \$19.95)



36 WAY CENTRONICS **CRIMP PLUG**

P12200 10-99 100 \$7.50 \$7.25



CANNON TYPE AUDIO CONNECTIONS

3 Pin line male Cat P10960 \$1.90 \$1.80 3 Pin chassis male Cat. P10962 \$1.90 3 Pin line female \$1.80 n line female P10964 **\$2.50** n chassis female P10966 **\$2.90** \$2.10

\$2.20



RS232 & 'D' TYPE

CONN	ECTORS	
PART I	DESCRIPTION	CAT. No
1-9		10
DE 9P	9 Pin Female	P1088
\$1.75		\$1.6
DE 9S	9 Pin Male	P1088
\$2.25		\$2.4
DE 9C	9 Pin Cover	P1099
\$2.55		\$2.4
DA 15P	15 Pin Male	P1089
\$2.10		\$1.9
DA 15S	15 Pin Female	P1089
\$2.25		\$2.1
DA 15C	15 Pin Cover	P1089
** 45		

25 Pin Male

25 Pin Cover

P10900

\$2.80

\$3.30

P10902

\$1.10

DB 25P

\$2.95

\$3.45

DB 25C

\$1.20

CASES!



PROFESSIONAL SERIES RACK MOUNTING CABINETS

These beautifully crafted rack cabinet boxes will give your equipment a real 1st class appear-

- All aluminium construction All aluminium const.
 Removeable top and bottom
- panels.
 All dimensioning conforms to the International Standard.
 Natural or black finish.
 Ventilalted lid.
 Deluxe brushed finish anodised front panel.

H10402 Natural

H10403 Natural

H10401 Natural \$49.50 \$43.50

\$55.50 \$49.50

\$62.50 \$55.50

H10411 Black	\$49.50 \$43.50
H10412Black	\$55.50 \$49.50
H10413Black	\$62.50 \$55.50
	_
1.	1
1	
	1
1.	
(-	/

NEW SLOPING CASES

Plastic with metal from available in two sizes Cat H10450 190x120mm \$9.95 Cat. H10455 256x185mm \$17.95



ECONOMY 19" RACK CASE Tremendous Value! Dimensions W 480 x H 134 x D 250mm.

\$34.95 \$29.50

TOOLS OF TRADE!



DIGITAL MULTIMETER

- E YF1100 FEATURES Large easy to read 3 1/2 digit
- display Facilities for transistor and
- diode testing
 Clearly laid out front panel
 10A DC AC range
 Priced to undersell the others
- Cat Q16025 \$69.50





LOGIC PROBE 3800A

Features 20MHZ memory. TTL/ CMOS operation. Normally \$29 50 Cat Q11272 1-9

\$23.50



\$19.50

UNIVERSAL SOLDERING **IRON STAND** \$5.95 slashed to \$3.95

2K OHM MIII TI METER 11 Ranges, pocket size.

11 RANGES DC VOLTAGE: 0-10-50-250-1000 volts 2000 ohms/volt AC VOLTAGE: 0-10-50-250-1000 volts 2000 ohms/volt DECIBELS: -10 to +22dB in four ranges OHMETER: 0-10 k/ohms , 0-1

mega-ohms.
DC CURRENT: 1-100mA
Normally \$14.95 NOW \$9.95



ONLY \$10.95 Cat. T12430



WE HAVE DONE IT AGAIN!! New multimeter at unbeatable

New multimeter at uniocustive value for under \$45! The new YU-FONG YFE-1030C features:

- Large 31/2 digit display. (1/2 inch high)
 Autopolarity. "-" display for Negative input.
 High over-load protection for
- all ranges
 Over-load display highest
 figure "1" or "-1" alone glows
 Power consumption 20mW
- \$49.95

IC's GALORE!



IC SPECIALS!				
	1-9	10 -		
4116	\$1.80	\$170		
4164	\$3.25	\$2.95		
2716	\$5.90	\$5 50		
2732	\$6.25	\$5.95		
2764	\$8.25	\$7.95		
27128	\$12.50	\$11.50		
6116	\$5.50	\$5.15		
41256	\$14.50	\$12.50		

BATTERIES!



RECHARGEABLE 12V

Leakproof and in 3 convenient sizes, these long service life batteries are ideal for burgular systems, emergency lighting or as a computer backup power supply ideal for many power needs.

Cat. S15029 12V 1 2 AH \$17.95 Cat S15031 12V 2 6 AH \$39.50



NICAD BATTERIES

\$4.95 Cat S15022

\$7.95

Save on carbon batteries with these Appolon Nickel cadmiums. Rechargeable up to 1000 times! 1.9 10+ Cat \$15020 AA500 MA \$2.45 \$2.25 C1.8 AH \$15021

\$3.95 \$6.95

HARDWARE!



SWITCH MODE POWER SUPPLY

DC+5V at 3A, +12V at 1A DC-5V at 200mA, -12V at 500mA Dimensions: L250 x W90 x H55mm



BRAND NEW FANS

Not noisy pullouts! Stacks of uses in power amps, computers, hotspot cooling etc. Anywhere you need plenty of air. 240V 45/8" Cat. T12461 **\$10.95**

115V 45/8" Cat. T12463 \$10.95 240V 31/2" Cat. T12465 \$10.95 115V 31/2" Cat. T12467 \$10.95



10 Fans (mixed) less 10%

KEY SWITCHES

Cat S12500 \$4.95 \$3.95



U.V. TUBES

Fits into standard 15W flouro holder Suitable for Scotchcal, Eprom erasing etc. As used in ETI Eprom Erasing Kit Erasing Kit WARNING Do not look directly into UV Tubes Cat H28600 "If ordering by mail please include an extra \$2 for "special" packing

TELEVISION ACCESSORIES!



HYBIRD SPLITTERS

2 WayInput Output 75 Ohm Splitting loss 3 5dB

4 Way
• Input Output 75 Ohm
• RdB

Input Output 75 Ohn
Spilitting loss 6 8dB
Isolation 32dB
V S W R 1.3

Cat 1 11320 \$5.95 300 OHM COUPLERS

\$3.95

Cat L 11300



CONNECTORS

\$0.95 Plug Cat P10402

UHF/VHF/FM ANTENNA

Frequency: VHF 48-216 MHz (Ch 1 12 UHF 536-764 Mhz (Ch 25-62 Impendance: 75 300 (200) Ohm

Gain (dB):VHF 4-6 UHF 4-8 \$39.50



Female \$2.95 Male to Female \$2.95



TRANSFORMER Female Type 75 300 Ohm

MATCHING BALUN TRANSFORMER

75/300 Ohm Type Cat L11038

\$6.95

\$2.95

CIRCUIT **EQUIPMENT!**



S100 PROTOCARDS SAVE \$20 Horizontal Buss

\$19.50 \$19.50



NEGATIVE & POSITIVE CIRCUIT RESIST

Make your own presensitized PC Boards POSITIBE PHOT RESIST using 1.1 tapes and pads on clear film for one off or prototypes. Resist 50ml bottle for approx. 1500 sq cm

DEVELOPER: 70gms of crystals to mix with 2lt of water, enough to complement 50ml of resist Cat P85504 \$3.25

NEGATIVE PHOTO RESIST for using normal negative PCB images Resist 50ml bottle for approx. 1500

DEVELOPER: 500ml bottle enough to complement 50ml of resist. No dilution required Cat. P85510 \$8.50

ETCHANT: 400gms of crystals to mix with 1 to 11/2 its of HOT water Cat. P85512 \$3.25



FULL STRENGTH FERRIC CHLORIDE \$1.95

1.75 250ml \$2.95 \$2.50 500ml 4.50 \$4.95

Rod Irving Electronics!

SECURITY **EQUIPMENT!**



LOCAL BURGULAR ALARM CONTROL

odds against you are bing and prevention is better

- climbing and prevention is better than cure!

 Adjustable exit/entry time delay and alarm time (avoids unnecessary noise pollution 12V D.C. 15Amp
 Provision for battery back-up. Tamper switch
 Optional outputs: Sirens, bells, floodlights, automatic diallers, tape recordings, closed circuit
 Tamer switch
 Accepts N.C. and N.O.
- TV, etc. Accepts N.C. and N.O. detectors such as infrared, microwave, ultrasonic, wireless, vibration sensor, magnetic switch, door mat, smoke detector,glass breakage sensor panic button etc.



ULTRASONIC

- ULTRASONIC
 BURGULAR ALARM

 Easy to install
 Connect with magnetic switch infrared detector, etc.
 Equip with hornspeaker, lockswitch, flashlight, closed circuit TV, etc.
 Rechargeable battery circuit with recharge indicator L.E.D.
 N.O. and N.C. circuit breakdown indicator
 L.Ow dry battery indicator
 Cat. S15052

 \$89.95



GLASS BREAKAGE DETECTOR

stable for closed circuit or open circuit type glass. Instructions supplied. Cat. 15060



HORN SIREN

\$14.95 \$13.95



ULTRASONIC MOTION DETECTOR

DETECTOR
A compact design that can be
used with virtually any alarm syster
which has an input for N.C. or N.O.
external sensor. Coverage is
approximately 110 degree angle
and up to 8 metres. Comes with
detailed instructions.
Cat. S15033
\$39.99 Cat. S15033



MOUNTING BRACKET For above Ultrasonic Alarm and features ball pivot for horizontal and vertical adjustment.

Cat. S15042 \$11.95

VIDEO ACCESSORIES!



TDK VIDEO TAPES

AT BA	RGAIN P	
VHS:	E60	\$12.50
	E120	\$12.50
	E180	\$11.80
	E240	\$22.40
BETA:	L250	\$13.50
	L500	\$14.40
	L750	\$17.50
The second secon		



VDK1 VIDEO

DUBBING KIT

Contains:
Contains:
Audio/Video: 6 pin DIN plug to 6 pin
DIN plug 1.5 metres.
Audio/Video: 6 pin DIN sockt to
(a) Video: 16 pin DIN sockt to
(a) Video: 16 pin DIN plug (b) Audio: 5 pin
DIN plug. (Both 16cm in length)
Video: 1 each plug adaptor (PA21)
RCA socket to BNC plug.
Audio: 5 pin DIN socket to 2 RCA
plugs 16cm length 2 plug adaptors
(PA60) RCA socket to 3.5mm phone
plug.

AUDIO PRODUCTS!

\$16.95



P.A. SPEAKERS

prices! Cat. C12000





Would you like a quality sound system in your car? .at an affordable price?!!

Rod Irving Electronics now sell quality Ferris sound systems (A quality Perris sound systems (A brand everyone knows and trusts.) Prices start from a very affordable \$55.95. Feel free to call in for a personal demonstration at either of our two stores.

FERRIS 1600: AM/FM Manual Car Radio, Integrated Circuit, Automatic Dual Polarity.

FERRIS JM 700: AM/FM/MPX FERRIS JM 700: AM/FM/MPX Addio/Auto Reverse Cassette Stereo with Lock-in F/Forward and LOC/DX Switch, Output 7 Watts per Channel Balance and Tone Controls. Overall Dimensions 162(W)x114(D)x44mm(H)

FERRIS JMP 400B: Auto Reverse Stereo Cassette Player with AMF-MMPS Electronic Scanning, Digital Badio and Digital 12 Hour Clock 12 Station Memory, Metal/Normal Tape Switch, BW/8W Max. Local/DX Switch, FM Interference Absorbtion Circuit, Base and Treble Control.

FERRIS FA 1004: 10 Level Graphic Equaliser Amplifier with LED read-out on L & R Channels, Fader Control, 20W/20W

FERRIS FA 104: High Power Module. up to four times your volume, suits all Ferris Normal Power Sets and most other Car Stereo Units with Normal IC Output

FERRIS F7 55X: Flush Mount 4-8 OHM, 5oz. Dual Cone, 5 Watts NOM, 10 Watts Max, Mesh Grille.

FERRIS TRI-510: "Super Power Deluxe", Flush Mount, 4 OHM, 10 oz., Triaxial Three Way, 6 1/2 inch Diarmeter, Mesh Grille 40 Watts Max.



SUPER HORN

- \$12.95



PHILIPS SPEAKERS You don't have to "imagine" Philips

\$12.95 Cat. C12040 AD02160 SQ8

\$34.95 Cat. C12045 AD70620 M8 \$49.00 Cat. C12050 AD12550 W8

\$79.00

JOYSTICKS!



CENTRE RETURN

Features 2x150K pots, long shaft 40mm with 25mm control ball. Bonus adjustable offset feature on pots. Cat. X15637 1-9

\$9.95 \$8.95





JOYSTICK FOR APPLE

processing. Fits most 6502 "compatible" computers.

Cat. C14200

COMPUTER **ACCESSORIES!**



COMPUTER PAPER Top quality at a very affordable price! Blank 11 x 9¹/2", 2,000 sheet, quality 60 gsm bond paper.

\$29.50



RITRON (ZETA) DATASETTE

For data loading and saving, this Micron Datasette suits most home



RITRON 2 Stylish swivel be available in amb 100+ Green Cat. X14500

\$215 \$205 er Cat. X14500 \$219 \$205



RITRON MULTI PURPOSE MODEM Our New RITRON Multi Purpose

Our New RITRON Multi Purpose Modem has arrived and has all the standards you require. Just check the Ritron's features

- CCITT V21 300 Buad Full duplex
 CCITT V23 1200/75
 Bell 103 300 Full duplex
 Bell 202 1200 Half duplex
 Auto answer, auto disconnect.
 Telecom Approval No. C84/37/1134 \$399



RITEMAN INFO RUNNER

An exciting new printer from the experts "Riteman". This compact stylish printer performs like printers twice its price and size 120 C.P.S., dot resolution graphics, tractor/friction feed, 10" paper.



M4851

ne 51/4" disk drive. Double sided, double density 500K unformatted, 40 track/side. Steel band drive system

Cat. C11901 \$199 Case & Power Supply to suit \$89



TELECOMMUNICATION PLUG TO 2 SOCKETS.

Ideal for modem connections



READY MADE CABLES

Cat P19011 \$23.95 Cat P19013



IBM* COMPATIBLE COMPUTER \$2,450 Including Tax!

'IBM is a registered trademark

CHEAP DISKS!



DISKS GALORE!!

SPECIALS!

MD525-01 S/S D/D Cat. C12501 \$29.50 MD550-01 D/S D/D Cat. C12504 \$39.50 Head Cleaners

C12551 5" Head Cleaner C12851 8" Head Cleaner VALUELIFE

C12421 S/S D/D C12425 D/S D/D

8" Verbatim 6 Verbaliii C12800 FD32-1000 S/S S/D C12801 FD32-8000 S/S D/D C12802 FD32-9000 S/S D/D C12803 FD34-1000 S/S D/D C12804 FD34-8000 S/S D/D C12805 FD10-4008 D/S S/D C12806 FD10-4015 D/S S/D C12807 FD10-4026 D/S S/D

C12808 FF32-2000 S/D D/D C12809 FF34-2000 S/D D/D C12810 DD32-4000 D/S D/D C12811 DD34-4001 D/S D/D C12811 DD34-4008 D/S D/D C12812 DD34-4008 D/S D/D C12813 DD34-4015 D/S D/D C12814 DD34-4026 D/S D/D

51/4" Verbatim Disks

\$29.50 C12501 MD525-10 \$39.50 (S/S D/D 10 Sect. 40 Track) C12502 MD525-16 \$39.50 (S/S D/D 16 Sect 40 Track) C12503 MD550-01 \$39.50 C12504 \$49.50 10 Sect 40 Track) C12505

MD550-16 \$49.50 (D/S D/D 16 Sect 40 Track) C12506 MD577-01 \$49.50 (S/S D/D Soft Sect 80 Track) C12507 MD577-10 \$59.50 (S/S D/D 10 Sect 80 Track) C12508 MD577-16 \$59.50 (S/S D/D 16 Sect 80 Track) C12509

MD557-01 \$59.50 (D/S D/D Soft Sect 80 Track) C12510 MD557-16 \$59.50 (D/S D/D 16 Sect 80 Track) C12511



XIDEX DISKS

1-9 Box of 10 S.S. D.D. Cat. C1240 \$34.50 \$29.50 Box of 10 D.S. D.D. Cat. C12410



DISK STORAGE BOXES

Efficient and practical, the storage boxes protect your disks from being damaged or lost. 50's.Features smoked plastic cover with provision for a lock. High impact ABS plastic base.

Cat C16025 50's.Features smoked plastic cover. Divided into 10 sections, each fan elevates the disks for easy identification and access.

Cat. C16050

CASSETTES

Brings out th Cat. D11141 \$1.40 \$1.20



SWIVEL BASE

\$29.50. Cat. D11100 \$27.50

PUBLICATIONS!



Inside CP/M \$41.95

The complete Home Video Book Vol. 2 \$25.95

The Robotics Primer by Robert A. Ullrich



ROD IRVING ELECTRONICS 425 High Street NORTHCOTE, 3070 VICTORIA, AUSTRALIA Phone (03) 489 8866 TELEX: AA 38897 48-50 A'Beckett Street, MELBOURNE, 3000 VICTORIA, AUSTRALIA Ph. (03) 663 6151 Mail Order and correspondance: P.O. BOX 235 NORTHCOTE 3070

MAIL ORDER **HOT LINE**



(03) 481 1436

POSTAGE RATES \$1-\$9.99 \$2.00 \$10-\$24.99 \$4.00 \$25-\$49.99 \$50-\$99.99 \$5.00 \$100-199 \$7.50 \$200-\$499 \$10.00 \$500 plus \$12.50 This is for basic postage

only, Comet Road freight,

y and fragile items





Errors and ommisions excepted

All in one video-audio disc player

Pioneer in Japan has recently issued a formidable challenge to Philips with the release of an optical videodisc player which can also play digital audio discs.

Philips' Laservision discs are 30 cm in diameter while the audio discs are only 12 cm, and the two are played at different speeds. Pioneer's new player has two motors and the player switches between them so that both video and audio discs can be played.

Pioneer also had to come up with a system to modify the laser

focus for the different discs, since the set standard for video was a double-sided disc slightly over 2.5 mm and for audio, a single sided disc of 1.2 mm thickness. The company solved the problem by using a servo control system that refocuses the optics according to the type of disc being played.



Latest Teac amp

Teac's latest amplifier is labelled the A-919. Rated output power is 110 watts per channel using "phase inverted drive" circuitry to amplify left and right channels, out of phase. The theory behind this is to provide a more stable power supply and maintain transient response.

The amplifier has facilities for nine audio inputs (naturally including CD) and (in the interests of limited lifespan) permits you to record from one source while listening to another. As an extra it also has a built in MC cartridge amplifier.

For further information contact Teac, 115 Whiteman St, Sth Melbourne, Vic 3205. (03)699-6000

New VHS video system

The latest offering from JVC is a new component video system which provides both portable recording facilities and at-home broadcast reception. A 'mixn-match' system, it may well provide a solution to choosing between a home deck VCR and a portable.

The new system consists of a HR-S10EA video cassette recorder and matching TU-S10EA tuner adapter. Used together, these matching components give complete broadcast reception and time-shift viewing capability. To record live action, it's simply a case of removing the tuner and adding a video camera (all JVC models are compatible!).

Weighing only 2.4 kg and just 8 cm high, the HR-S10EA recorder is one of the lightest and smallest VHS models on the market for full-sized cassettes. It allows 4 hours of recording on a single E-240 cassette

The TU-S10EA voltage synthesizer tuner can be preset to 16 channels and has a built-in 14-day/8-event timer. A protective flap conceals the keyboard, giving a sleeker appearance.

There are no unsightly cables connecting the recorder and tuner. These components simply slide out of their cordless, direct contact electrical connection in one smooth motion.

Other features of the component system include a dubbing connector, earphone and microphone jacks, audio dubbing facilities, automatic backspace editing, direct playback, threeway power supply, two-way shuttle search, full function wireless remote control, electronic tuning (both manual and automatic) and still frame. frame advance and even reverse normal speed playback. Advanced post production editing and audio dub features which allow the user to give the recording a professional touch are also incorporated. A full range of accessories is available.

The recommended retail price for this new video system is \$1,899 which includes a carry bag and two batteries.

For further information, contact Anthony Toope, Hagemeyer (Australasia) B.V., 5-7 Garema Circuit, Kingsgrove NSW 2208. (02)750-3777.

AKAI VCR



AKAI Australia has incorporated a number of important design changes in its latest VS-303 video cassette recorder, which replaces the VS-3EA model.

Following current market trends, this new VCR is a slim-line model, 99 mm high, and is compatible with all AKAI's current hi-fi range and therefore suited to a visual integration unit. It has a full function infrared remote control that can even be used to change channels on the TV set.

In common with all other Akai VCRs, the VS-303 features an exclusive on-screen instruction system which displays all operating instructions. The interactive monitor system is slightly changed from those of previous models and now incorporates an am/pm clock. Another change is the incorporation of a 16-channel preset tuner, which is easy to operate and error free.

The VS-303 is built on a new chassis designed for simpler service and incorporates a silent mechanism so that loading and unloading a tape is no longer accompanied by the usual mechanical groans.

Another innovation is a tape view system that allows the user to actually see the tape inside the machine, thus eliminating the frustrating guesswork as to how much recording time is left.

This new model also features improved picture quality in normal playback and in noiseless still picture functions, a quick finder with fixed noise bars, sharpness control located on front panel, auto '0' stop and auto-rewind, auto-editing, a 4-programme, 28-day timer, and sleep timer.

The VS-303 is covered by Akai's three-year warranty and sells for a recommended retail price of \$729.

Light compact video

At only 720 g the Konica CV is light and easy to use. It has a minimum of controls to leave hands and concentration free for more important things like aiming, focusing and shooting.

The camera features zoom control, automatic iris system to set exposure, high sensitivity 1/2-inch new Cosvicon pickup tybe with f 1.5 Konica Hexanon lens. The colour temperature compensation control combines several settings into a single operation to avoid worrying about white balance and other adjustments.

As well as these features the Konica includes a unidirectional microphone, and an electronic viewfinder on a 1-inch (diagonal) black and white picture tube.





Sleek video

Following successful sales of the NV-600A VTR, National has introduced a slimmer, sleeker version with the feature packed NV-450A.

Its three-video-head System provides special playback functions such as playback with reduced noise and jitter, and still advance. A slow motion effect is obtainable also (1/6 normal playback speed) by keeping the Still Advance button depressed.

For the opposite effect, cue and review operate at five times normal playback speed.

The NV-450A is equipped with a 27-mode infrared remote control and has a large fluoresmulti-function display panel which gives instantaneous confirmation of every activated function at a quick glance.

Other features include a 14day programmable timer; onetouch timer recording with stand-by function for deferred OTR start; auto-rewind and memory function.

For more information contact National Panasonic, 99 Epping Rd, North Ryde NSW 2113.

BRIEFS

Hi-tech decks

Latest additions to the TEAC Australia lineup are the R-555 and R-666X Auto Reverse Stereo Cassette Decks, retailing at around \$449 and \$549 respectively. The makers claim the auto-reverse mechanism of these models is near perfect and music loss is imperceptible when the tape reverses direction.

Korean VCRs for US

The first Korean VCRs have just hit the United States. Three companies are involved — the Gold Star Company, the Samsung Electronics Corporation and the Dae Woo Company and orders could total 300,000 units this year. The Korean VCRs are aimed at the low end of the market and priced at approximately 5-10% below comparable Japanese models a point of interest as this new market initiative follows the recent termination of licensing agreements with Japanese manufacturers which had prohibited the Koreans from export sales.

New AKAI colour TV

AKAI's move into colour TV gains force with the release of the new CTK-201 48 cm model. Featuring VCR stereo compatibility and automatic fine tuning, it joins the CTK-141 34 cm model in the range.

Hi-fi VCR

The latest in hi-fi VCRs comes from NEC, with the release of the N895EA model which incorporates a host of advanced hitech electronic features. Product manager John Hurley promises "audio sound quality similar to a CD player".

Audiosound stereo simulator

Audiosound Laboratories of Curl Curl, NSW offer "an excellent spatial stereo effect" with its SS-2 Linear Frequency Stereo Simulator. It has none of the problems associated with either comb-filter types or highly complicated units.

International video contest

Entries are now being received for the 8th annual Tokyo Video Festival contest, which runs until September 10. Competition details are available from any office of this year's festival sponsor, JVC, or by writing to Anthony Toope, Hagemeyer (Australasia), B.V., 5-7 Garema Circuit, Kingsgrove, NSW 2208.

Audio tapes

New to the audio tape market comes the Goldring UD (ultra dynamic) cassette range from Goldring Audio Industries. The range includes three different types of tape: the UDC 10 and UDC 20 for home computer use; the UDC 30, 45, 60, 90 and 120 for hi-fi recording; and a head cleaning tape. Prices are moderate — RRP for the UDC 90 is \$2.95.

LaserVision for China

Philips has received a \$A148 LaserVision order from the Municipal Government of Shenzhen in the People's Republic of China. A basic contract has been signed for the supply of both LaserVision players and equipment to enable them to be assembled in China.

Compact cassette

A new direction for features in portable equipment? Sony's CFD-5 radio-cassette player, just released on the Japanese market, comes complete with a compact digital audio disk player — the small D-50 introduced at the Japan Electronics Show last October. An export version will be ready for the United States later this year.

J-Compo 51 jacket size stereo component system

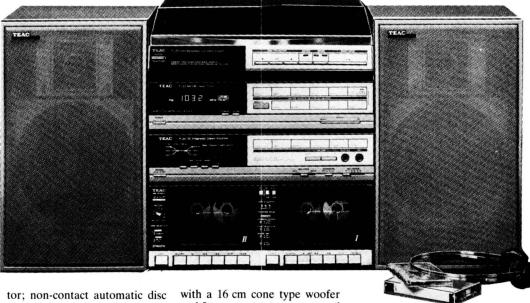
The Teac J-Comp 51 stereo component system features the following discrete systems:

A_zJ51 dc integrated stereo amplifier with 30 W/Ch rated output power; electrically controlled volume buttons; tone control mode select with a visual display; and mic mixing capability.

The T-J51 AM/FM stereo tuner with microcomputer controlled quartz PLL (phase locked loop) tuning; random preset station memory (up to 16 AM/FM stations); and two colour fluorescent preset channel and frequency display.

The W-J51 stereo double cassette deck featuring dolby B-C noise reduction; high speed dubbing function; continuous double-deck playback; line/mic and tape mixing recording capability; and two dc servo motors.

The P-J51 fully automatic turntable with linear tracking tone arm; non-contact optoelectronics tracking error detec-



tor; non-contact automatic disc size and speed detector; and program repeat function.

The S-J51 two-way speaker system which comes in a bass-reflex bookshelf type enclosure

with a 16 cm cone type woofer and 5 cm cone type tweeter; and crossover frequency of 8500 Hz. Its input power is 30 W (nominal), 60 W (maximum music signal peak).

For further information contact Teac Corp, 115 Whiteman* St, South Melbourne, Vic 3205. (03)699-6000.



Buying a computer?

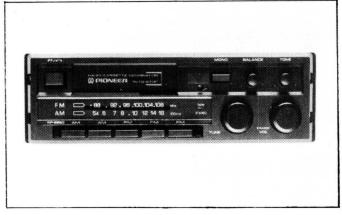
Here's a magazine that's sure to help you!

We aim to provide you with the information you'll need to compare, evaluate — and make the right decision on which computer is right for you.

We've collected a wealth of articles, written by rank beginners as well as those deeply experienced in the computer industry. All of them have gone through the drama of buying a personal computer . . . and they'll share their experiences with you.

Available at your newsagent now only~\$4.50

The soft look KP2950



Pioneer has released a new 'soft face' design technology car stereo with the KP2950 AM/FM stereo radio cassette combination.

At its recommended retail price of \$179, the KP2950 has a front-DIN or 'soft-face' car system which uses buttons and flush controls instead of shafts.

The unit also features five preset tuning buttons for the tuner section, while the tape player alerts the user at tape end with an LED indicator.

Radio reception is protected from pulse noise interference by the inclusion of Pioneer's own PNS synthesizer circuit.

The KP2950 has been designed for easy-fitting into all popular modern cars and will play through a wide range of Pioneer speakers.

For further information, please contact Pioneer on (03)580-9911.

Sharp video camera

Sharp's new XC-78 is designed to appeal to those who produce professional videotapes. A switch operation allows titles or dates to be imposed (up to 48 characters in length), while it features half-inch Newvicon pickup tube and the f 1.2 lens allows pictures to be taken in as little as 10 lux.

The camera also includes auto focus, switches to adjust white balance and a tint control knob.





Easy operation video from National

The new National VTR NV-250A is designed with a three video head system offering still/still advance and still playback functions to stop the picture. It is noiseless and jitter free. Slow motion effects are obtainable by holding down the still advance.

Other features include 16-sta-

tion quartz synthesizer tuning, picture sharpness control, auto rewind and memory function and cue/review at five times normal speed.

For further information contact National Panasonic, 99 Epping Rd, North Ryde, NSW 2113. (02)887-5315.

Perreaux Tone Control

For those people with Perreaux pre-amps and power amps who want a tone control, Perreaux has released the T2 dual channel tone control unit. Specs for this unit include 20 Hz to 20 kHz distortion at maximum output with centred tone controls; THD 0.002% at 1 kHz rising to 0.009% at 20 Hz to 20 kHz; less

than 100 dB noise; and 60 dB channel separation at 20 Hz to 20 kHz.

The unit comes with a class A mosfet headphone amplifier.

For further information contact Eurovox, 70 Princes Highway, Arncliffe, NSW 2205. (02) 597-6611.

Perth Electronics show

The Perth Electronics show starts at the end of next month. The organizer's expectations have it that there will be as many as \$100,000 visitors this year.

As this major Australian consumer electronics show closely

follows the major Chicago Consumer Electronics Show, visitors can expect a few first time Australian releases.

For travel arrangements contact Jebsens Travel (02) 922-4300.

ACOUSTIC CALIBRATION LABORATORIES

WE HAVE MOVED!!!

New laboratory at 27 ROSELLA STREET, DONCASTER EAST

An Independent Laboratory

SPECIALISING IN TESTING OF-

Microphones, sound level meters, filters, acoustic calibrators, measuring amplifiers.

ENTERTAINMENT EQUIPMENT

Tape recorders, turntables, pickups, amplifiers, loudspeakers.

SOUND SURVEYS

Environmental and Industrial

Contact our qualified engineering staff for details

Sound reasoning for sound analysis ACOUSTIC CAL LABS—A Division of

ACOUSTIC CAL LABS—A Division of Associated Calibration Lab. Pty. Ltd.



Phone: (03) 842 8822 Telex AA35011



Registered by National Association of Testing Authorities

JAYCAR - YOUR NO.1 STORE FOR GREAT

Because of the devalued Australian Dollar we have sourced some Aussie manufactured items that are outstanding value for money! Check the "Aussie Made" logo in our ads for locally made goods at great prices! Remember! Aussie made goods means your precious dollar stays here!



AT LAST! **An Economical** RACK CABINET **MOUNTING SYSTEM!!**

This fully Australian-made product we believe will become one of our hottest selling items!

It has taken an Aussie manufacturer to come up with the world's first low cost rack mounting system especially for the budget-conscious home constructor!

conscious home constructor!
The rack mounting system basically consists of specially designed aluminium-extruded frames. Moulded plastic corner and feet pieces connect the extrusions together to form a rigid frame. No spanners, screwdrivers are needed but the use of a rubber or wooden mallet is advised to securely fit together the self-aligning pieces. When assembled the frame can be further strengthened with pop rivets. The system is supplied in knocked-down (kit) form to keep costs and freight down. Assembly takes around 20 printles and instructions are simplied in keeping with the low. to incept costs and instructions are supplied. In keeping with the low-cost philosophy, side and top panels are not included. Any reasonably competent reader should be able to fashion wooden or metal panels to suit. (Edge finish is not necessary as the panels recess into the frame). Jaycar will have special side panel sets available shortly however. Please watch our ads for further details.

THE RACK IS AVAILABLE IN 3 SIZES

6, 12 and 18 rack unit

(One rack unit is 44.5mm or 1¾"). Each kit comprises: ★ 12 frame pieces, including 2 pieces with pre-punched holes for front panel mounting. Natural anodised finish. (You can use the rack back-to-front to mount non-standard r 4 top corners (black) ★ 4 bottom corners (black) clip-in M-6 nuts (for mounting your equipment) \bigstar 4 x M-6 Phillips head mounting screws \bigstar easy to follow instructions. But the best part about this exciting concept is **THE PRICE!**

Cat. HR-5310 6 RACK FRAME \$ 99
Cat. HR-5320 12 RACK FRAME \$ 119 Cat. HR-5330 18 RACK FRAME \$139

Extra M-6 captive nuts (Pack of 12)

Cat. HP-0640 **\$4.95** Extra M-6 x 16mm plated Phillips head mounting screws (pack of

Cat. HP-0645 \$2.95

AVTEK MULTIMODEMS

State-of-the-art multimodem - has the following data standards CCITT V21 & V23, BELL 103 & 202 - Data rates 300, 600 & 1200 BP5 - Backward channel 75 BPS in conjunction with 1200 BP5 - Computer interface CCITT V24 (RS232C) - Power requirements 240V AC3 watts Talk to the world with this fine Multimodem.



★ 300 Baud full duplex ★ Answer/originate ★ Plugs straight n (hardware phone ★ Superior VLSI chip performance (identical to Multimodem) ★ Telecom approval C84/37/1173.

Cat XC-4825

ONLY \$199.00

FREE CATALOGUE

Ask for a FREE COPY of our 1985 Engineering Catalogue or send large SAE with 50¢ stamp.

JAYCAR JVE-1 VIDEO DETAIL ENHANCER

(For technical details see page 15 of our catalogue or send SAE). This is made in Australia exclusively for Jaycar. It was designed at a well-known Australian University. It was designed with Australian standard video systems in mind and beats the pants off some expensive imports!

(Power adaptor Cat. MP-3020 only \$9.95 extra)

Cat. AV-6501 ONLY \$69.95



1/4" (6mm) BRASS Clearance Spacers

Bulk packs - from as low as 6¢ each! We are pleased to announce that we are having these MADE IN AUSTRALIA. They are high quality, natural brass finish and will allow a 4BA screw to pass through with clearance. They are 14" dia. as well.

YOU CAN BUY THEM FROM US IN PACKS OF

8 Cat. HP-0860 \$ 0.95 100 Cat. HP-0870 \$ 8.50 500 Cat. HP-0871 \$30.00

MAIL ORDER HOTLINE

To save you time (and therefore money) we have installed a special HOTLINE direct to the inner workings of our mail order dept. This saves you from going through our Head Office switchboard! If you wish to place an order, enquire about an order or simply check for more information, call:

(02) 646 1300

GREAT NEW PRODUCTS!!!

Our ongoing product development brings you unique every month!

RCA Plugs - Yellow and white covers. They match red and black for identification of stereo input/output leads.

		1-9 10+
Cat. PP-0240 RED	\$0.45	\$0.40
Cat. PP-0242 BLACK	\$0.45	\$0.40
		\$0.40
Cat. PP-0244 WHITE	\$0.45	\$0.40
	Cat. PP-0242 BLACK Cat. PP-0243 YELLOW	Cat. PP-0240 RED \$0.45 Cat. PP-0242 BLACK \$0.45 Cat. PP-0243 YELLOW \$0.45 Cat. PP-0244 WHITE \$0.45

5 pin DIN plug 270° spread of pins. These plugs are used in Shielded backshell computer and some video applications.



Cat. PP-0305 \$0.90

\$0.82

Electricity Authority Approved Fuseholder! At Last! A 3AG

240V 10A fuseholder that is approved but at a reasonable price! (Approval No. CS2929). Ideal for manufacturers.

Cat. SZ-2025 ONLY \$3.95



Blue Strobe Flasher 12V This unit has

a magnetic base and is fitted with 4 metres of cable terminating in a cigarette lighter plug. Ideal for car alarms or fitted to a siren cover to bring visual attention to a theft.



Cat. LA-5105

ONLY \$32.50

NEW! Longer TV plug-to-socket Fly leads (75 ohm)

Cat. AV-6580 1.8 metre Plug-to-Plug \$3.20 Cat. AV-6582 1.8 metre Plug-to-Socket **\$3.45** Cat. AV-6584 4.5 metre Plug-to-Plug **\$4.95** NEW! Cat. AV-6585 4.5 metre Plug-to-Socket \$5.95 Cat. AV-6586 10 metre Plug-to-Plug \$9.75 NEW! Cat. AV-6587 10 metre Plug-to-Socket \$10.95



COAXIAL Cable Joiner Now you can join 3C2V, RG59, RG58, SC2V coaxial cables together WITHOUT SOLDER with this nifty cable joiner!

Cat. PS-0618 ONLY \$1.50



Solderless BNC line plug This enables

you to terminate coax in the field without a soldering iron! Reliable screw connection withstands flexing.

Cat. PP-0652 ONLY \$2.75



At Last! A car 12V cigarette lighter SOCKET! A panel mount source of 12V for cars, boats, planes. You even can plug a cigarette lighter into it!

Cat. PS-2002 ONLY \$4.50





NEW! Gel-cell Battery Charger

Specifically for charging Gel-cells with 1/4" quick connecthem. 240V AC to 12V DC @ 300mA ensures fast char charge

Cat. MB-3506 ONLY \$10.95

MOTOROLA PIEZO TWEETER BARGAIN!

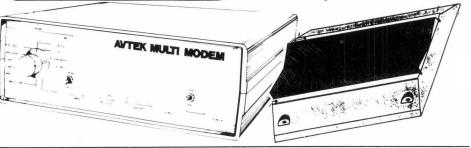
Quite frankly we were staggered when an importer came to us with his dilemma. We couldn't believe our ears when we were told the price of the genuine US-made Motorola brand KSN-1071 high performance tweeter. "With such a strong US dollar" they said the periormance weeter. With such a stong of dollar mey said they price we offer to you is far below our current replacement cost. This HI-FI high power tweeter is a surface mount, controlled dispersion line source unit that is fitted with its own grille panels. alspersion line source unit intent is nitted with its own grine paries. The use of high temperature materials in its construction enables it to be used in automotive applications. Two piezo elements provide a wide (90) dispersion horizontally with a narrow 30 dispersion vertically. Sensitivity is 98dB © 2.8V @ ½m. Frequency response easily goes out to 40kHz but this can be limited with external passive components if necessary. A comprehensive data sheet is supplied, which includes frequency response graph, specs, mounting details etc.

specs, mounting details etc.

The KSN-1071 normally sells for a very reasonable **\$24.00**each (pre devaluation). While stocks last, this unit is available from Jaycar for the ridiculously low price of **\$12.95** each! That's right! A high quality, high power HI FI tweeter for a pittance HURRY!

Cat. CT-1918

ONLY \$12.95 each



PRODUCTS AT GREAT PRICES!!

SCOOP PURCHASE! | NEW! BY POPULAR DEMAND! SIEMENS

Universal voltage tester with LED indicator
The Siemens "UNISPANN" voltage probe has been around fo
some time now. You can determine the presence of AC or DO voltages safely anywhere with this quality probe. It will even tel you which AC mains conductor is active and works from 6-500\ AC or DC. It also shows DC polarity.

Normally these units are very expensive but a Jaycar SCOOP PURCHASE brings them to you at a great price!

WHILE STOCKS LAST - AN INCREDIBLE BARGAIN Cat. QT-2220



TELEPHONE EXTENSION LEADS Our purchasing guy is a "bunny" and now we've got them coming out of our ears! SAVE HEAPS while we are in this

5mExt. lead **\$9.95 SAVE \$5** _ 10m Ext. lead **\$12.95 SAVE \$7** . 15m wind up reel **\$12.95 SAVE \$7** . 20m wind up reel **\$14.95 SAVE \$8** YT-6010 5m Ext lead YT-6012 YT-6013 YT-6014





BLANK PCB - BARGAIN OF THE CENTURY

We have secured massive stocks of high quality copper-clad PCB material, in both single and double sided versions. Javcar has NEVER had the opportunity to sell material at anything NEAR this price before. We suggest that you stock up NOW as we doubt that we will EVER be able to repeat this bargain again.

OFFER 1

Blank, single sided board. Phenolic base. Dimensions approximately 350mm (14") x 330mm (13").

Cat. HP.9508 Limit 2 sheets per customer

Cat. HP-9508

May Only \$3.95 (Normally \$6.95) · SAVE \$3.00 **OFFER 2**

Blank, single sided board. Fibreglass base. Dimensions 350 x 330mm

Cat. HP-9510 May Only \$4.95 (Normally \$8.95) · SAVE \$4.00

OFFER 3

Blank, double sided board. Fibreglass base. Dimensions $300 mm (12^{\circ}) \times 300 mm (12^{\circ})$

Limit 4 sheets/customer

Cat. HP-9520 May Only \$6.95 (Normally \$12.95) · SAVE \$6.00

Note that the normal price is based on 300mm square sheets and not this larger size - an even greater saving!

FM TRANSMITTER MODULE

★ Ultra low noise output (−60dB or better attainable with suitable tuner)

- Input sensitivity adjustable max. 30mV
 Pre-emphasis 50us standard
 Dimensions 90 x 22 x 15mm (approx)
 Cat. DT-5450

Commercial Ultrasonic Pest

RepellerEverything that we have said about the Verminex domestic unit

except that it is for commercial applications! Sturdy metal cabinet

3 selectable pitch and loudness settings to optimise for particular problems
Low power consumption
14 day satisfaction guarantee

★ 14 day satisfaction guarante
 ★ Includes AC mains adaptor

YS-5510

ONLY \$159.00

ULTRASONIC PEST REPELLER

ultrasonic insect/pest ent which is totally hostile to the creatures mentioned.

HOW DOES IT WORK? The environment is relatively devoid of ultrasonic sounds. Evolution has not had a compelling reason to protect non-acoustic sensory mechanisms from ultrasonic stimulation. By subjecting an insect or rodent to a high level ultrasonic soundwave of a rotect non-acoustic sensory mechanisms from ultrasonic stimulation. By subjecting an insect or rodent to a high level ultrasonic soundwave of a articular pattern the creature begins to behave in a typical fashion. The pest becomes disoriented, lethangic and bewildered. The natural reaction is to scape from the sound-affected area. The sonic pattern is the secret and this pattern is a combination of scores of frequencies mixed together. The pattern

escape from the sound-affected area. The sonic pattern is the secret and this pattern is a combination of scores of frequencies mixed together. The pattern was developed by Professor JL. Stewart - the man who invented the Bionic ear. It works!

Like us, you would be skeptical at first that this would work. Our first reaction was, "If they are so good why haven't we heard about them before?" or "Surely a product like this: if it was any good - would have been around years ago." There have builtrasonic repellers around but none of them have the patented soundwave pattern of the Verminex. We have on our file, many letters of testimony to the fact that the Verminex is effective. The letters are from Australian Universities. Animal Husbandry research institutions, commercial Piggeries, restaunts etc. Many of them had several pest problems!

Your pest problems may not be as bad but it may still be a nuisance, which is why the domestic Verminex was developed. We are so confident of the Verminex units' effectiveness, we make the following offer.

Buy the Verminex from us and use it for up to 14 days (21 days for mail order customers). If you are not happy with the product after using it as directed, return it to us in a clean, original condition and we will refund your money in full! (Less post/packing). What have you got to lose?

The Verminex covers an area of 2000 sqft (uninterrupted) and is not cheap. But if the idea of dangerous chemicals, sprays, baits et worries you it's a great Cat. YS-5500.

12V DC powered

WHAT HAVE YOU GOT TO LOSE EXCEPT THE BUGS!

INFRA RED MOVEMENT DETECTOR

- Built-in test lamp
- Tamper switch included
- Alarm output SPST 30V DC @ 1A

MULTIMETER "PIN PLUGS" to

EZ HOOKS - Great multimeter probes that will fit the 2mm diameter pin tip sockets of your multimeter. (NOT "banana" type WT-5314 Normally \$3.95/set

this month \$1.50 WHACKO! Only 430 available. Hurry





UV EPROM ERASER Erase your EPROMs quickly and safely. This unit is the cost-effective solution to your problems. It will erase up to 9 x 24 pin devices in complete safery, in about 40 minutes for 9 chips (less for less chips). Erase up to 9 chips at a time

Chip drawer has conductive foam pad

Mains powered
High UV intensity at chip surface

ensures thorough erase Engineered to prevent UV exposure Long life UV tube

Dimensions 217 x 80 x 68mm Weight 670 grams

DNLY \$89.50



Incorporating ELECTRONIC AGENCIES

NUMBER 1 FOR KITS MAIL ORDER HOTLINE (02) 646 1 300 COMET ROAD FREIGHT ANYWHERE IN AUSTRALIA ONLY \$12

N.S.W

SYDNEY: 117 York Street. Tel. (02) 267 1614
CARLINGFORD: Cnr. Carlingford & Pennant Hills Road. Tel. (02) 872 4444
CONCORD: 15/117 Parramatta Road. Tel. (02) 745 3077
HURSTYILLE: 121 Forest Road. Tel. (02) 570 7000
GORE HILL: 188/192 Pacific Highway (Cnr Bellevue Avenue) 439 4799

QUEENSLAND BURANDA: 144 Logan Road. Tel: (07) 393 0777

MAIL ORDERS: P.O. Box 480, AUBURN 2144. Tel: (02) 643 2000 HEAD OFFICE: 7/9 Rawson Street, AUBURN 2144. Tel: (02) 643 2000 Telex: 72293

SHOP HOURS

SAOP HOURS
Carlingford, Hurstville & Gore Hill
Mon-Fri. 9am - 5.30pm; Thurs 8.30pm; Sat 12pm
Sydney
Mon-Fri: 8.30am - 5.30pm; Thurs 8.30pm; Sat 4pm
Concord
Mon-Fri: 9am - 5.30pm; Sat 4pm

POST & PACKING \$5 · \$9.99 \$10 · \$24.99 \$25 · \$49.99 \$50 · \$99.99 \$100 · \$198 Over \$199



32-bit CPU chip addresses 4G bytes

The George Brown Electronics Group has announced the availability of Zilog's Z80,000 CPU.

The Z80,000 is an advanced, 32-bit microprocessor that is said to integrate the architecture of a mainframe computer into a single chip. It is fully compatible with Z8000 software and hardware, yet it provides far greater power and flexibility in both

architecture and interface capabilities.

Designers can easily develop operating systems and compilers in the Z80,000 CPU environment. The hardware interface allows simple connection to a wide variety of system configurations.

Features include: virtual memory management integrated with the CPU; on-chip cache memory; general-purpose register file with sixteen 32-bit registers; sophisticated interrupt and trap handling; software that is a

binary-compatible extension of Z8000 software; ability to support both 16 and 32-bit buses.

Further information is available from the George Brown Electronics Group, 174 Parramatta Road, Camperdown, NSW 2050.

256K EPROM

The M27256 is a 262 144-bit ultraviolet erasable and electrically programmable read only memory. It is organized as 32,768 words by 8 bits and manufactured using the SGS NMOS-E3 process. The EPROM has a single +5 V supply and an access time of 200 ns.

An important feature is separate output control. Output enable (OE) is separate from the chip enable control (CE). The OE control eliminates bus contention in multiple bus microprocessor systems.

The M27256 also features a standby mode which reduces the power dissipation without increasing access time. The active current is 100 mA while the maximum standby current is

only 40 mA. The standby mode is achieved by applying a TTL high signal to the CE input.

The combination of the M27256's high density, and new advanced microprocessors with megabit addressing capability provides designers with opportunity to engineer high-performance systems.

The large storage capability allows it to function as a high density software carrier. Entire operating systems, diagnostics, high-level language programs and specialized applications software can reside in an M27256 directly on a system's memory bus.

Data is available from Ellistronics, 797 Springvale Road, Mulgrave, Vic 3170.

Fiberoptic connectors

The new Optalign metal shell fibreoptic connectors feature a four-rod glass element for inherent fibre self-aligning characteristics, cleanliness and chemical inertness. Used for coupling single-mode/multimode fibres. The connectors are immune to shock and vibration and have the ability to match fibre diameters which might be at opposite tolerance limits. The fibre alignment element does not demand precision tolerances and dimensions of its connector envelope to achieve low dB losses, resulting in lower connection

Optalign Model MM connector is suitable for 230 microme-

tres, 140 micrometres and 125 micrometres multimode fibres and offers 0.2 dB index-matched connections with 500 cycle durability. Model SM is designed for use with 125 micrometres, 110 micrometres and 70 micrometres single-mode fibres, offering less than 1 dB losses. Both models operate from -55 to +80°C.

The connectors are easy to assemble (in as little as 10 minutes) and the connectors do not require epoxies or fibre polishing tools.

For further information contact Total Electronics, 9 Harker Street, Burwood, Vic 3125. (03)288-4044.

Optocouplers with greater isolation

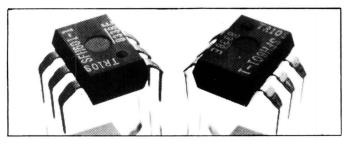
To lengthen the voltage breakdown paths between the pads on pc boards, Siemens has designed its optocoupler SFH 601 with a greater pin centre-to-centre distance.

On the new SFH 601 G the pins are 4/10 inch apart instead of 3/10 inch as in earlier versions. This increased spacing enables these optocouplers to be safely used in office equipment where, in compliance with IEC

380 an isolation distance of at least 8 mm is called for. The test voltage of 5.3 kV remains unchanged.

Another option from Siemens are optocouplers with the endsof the pins bent out at right angles. This design permits surface mounting and automated assembly.

For more details contact Siemens, 544 Church Street, Richmond, Vic 3121.



Microswitches are very small



Burgess Micro Switch Company has developed an ultra-miniature microswitch capable of switching 7 amps at 250 Vac.

The F5 ultra-miniature microswitches have an overall body size of 12.8 x 8.3 x 5.1 mm and weigh only 1 gram.

Burgess switches are available from Email Relays/Bellco Controls, 15 Hume St, Huntingdale, Vic 3166.

High performance voltage suppressors

Zener diodes have a certain amount of surge capability but in most instances the surge handling capability is not a specified parameter. TransZorbs are silicon p-n junction devices which have been designed tested as transient voltage suppressors. TransZorbs characterized by their high surge handling capability, fast response time, and low clamping voltge compared to their small physical size.

Different zener diode manufacturers use different manufacturing techniques in the formation of the junction. As both the process and the junction size are directly related to the surge performance, a standard JEDEC device purchased from one manufacturer may not have the same surge performance as the original prototype.

The surge performance of TransZorbs can be specified and test results and other data are available from Electronics and Semiconductor Distributors, Barrie Road and Adina Court, Tullamarine, Vic 3043.

BRIEFS

Fast CMOS 8086

Intel Australia reports that the 8086 and 8088 family of processors and peripherals will be made available in high performance, low power versions using Intel's CHMOS process. Processor power consumptions are of the order of 10 milliamperes per megahertz. For details contact Intel Australia, Level 6, 200 Pacific Highway, Crows Nest, NSW 2065.

High power IR diodes

Output powers of 900 mW/sr are possible at 1.5 A peak current from a new series of GaA1As infrared LEDs manufactured by Telefunken Electronics. The LEDs will be available from Promark Electronics, Suite 208, 6 Clarke Street, Crows Nest, NSW 2065.

Cables, connectors and such

Looking for cables, connectors, switches or accessories, then Acme Electronics has a new catalogue. The booklet covers components for audio to ultra high frequencies and is available from Acme, 205 Middleborough Road, Box Hill, Vic 3125.

Standard cell library

Total Electronics will be able to offer access to an expanded CMOS standard cell library following a joint second sourcing and development agreement in the US by Standard Microsystems and NCR. Information on the library, which includes analogue and digital cells, is available from Total, 9 Harker Street, Burwood, Vic 3125.

Reflective display components

Data on the Ferranti-Packard range of light reflecting electromagnetic display components is available from STC-Cannon Components. The products include seven segment and 5 x 7 matrix components up to 660 mm high. For details contact STC-Cannon Components, 248 Wickham Road, Moorabbin, Vic 3189.

Wideband op-amps

The Harris HA-2542 operational amplifiers have high slew rate and high output currents. Designed for pulse and video applications the devices have a power bandwidth of 5.5 MHz. For information contact VSI, 16 Dickson Avenue, Artarmon, NSW 2064.

CMOS 64K static RAM

Fairchild has made its CMOS memory debut with a 64K x 1 static RAM. Access speeds as low as 45 ns and a maximum standby power of 9 mA are quoted. Further information is available from Fairchild Australia, 366 Whitehorse Road, Nunawading, Vic 3131.

Pc board mount DIN sockets

Preh has introduced a line of pc mounting DIN sockets that comply with FCC rfi rules by providing a reliable connection between the socket and the cord plug. Available in three to eight pin versions, the sockets are distributed by Mayer Krieg, 246 Angas Street, Adelaide, SA 5001.

S

ave a fortune wh



FANTASTIC! \$439

Playmaster series 200 Hi fi **Mosfet Amplifier**

This is the one you've been waiting for. The all-new Playmaster Series 200 Integrated Amplifier is almost certainly **the best** build-it-yourself design to be published **anywhere in the world!** Feature for feature, dollar for dollar, it more than stacks up against the 'big names' in hi fi - with the big price tags to match.

And it has features that aren't even found on many of the 'names'. Features like electronic input witching. Circuitry to handle just about every input imaginable: moving magnet, moving coil, CD player, hifiVCR, cassette, tuner, etc etc etc. Plus, ov course, incredible 'headroom' with 100 watts per channel output power. And much, much more!

And don't forget the exclusive Dick Smith Electronics kit features:

*Solder-masked and silk-screened PCB to help eliminate errors. *Power transformer with factory-wound low voltage winding (why wind by hand?). *Special step-by-step construction manual *complete with our *Sorry Dick, it doesn't work "repair service. *PLUS our exclusive satisfaction guarantee: you can return the kit within 7 days if you think construction is beyond you!

Cat K-3516

4 Sector Home Alarm

Once upon a time, we had a kit for a simple alarm. Then everyone started asking for an all bells and whistles kit. So we brought out the EA 8 sector alarm kit. Now it seems everyone wants a simpler kit again!!!

Here it is: designed by Dick Smith Electronics Research and Development division to suit the requirements of the majority of users.

- Features instant or delayed inputs
 Wire-out-proof system suitable for all types of sensors
 LED sector and control state indication
- LED sector and control state indication
 Adjustable entry, exit and alarm periods

Short form kit - suits 'building in' to what-

Easy to build - and could save your property! Cat K-3254

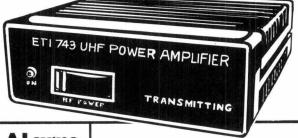


000000000

\$49

UHF Power Amplifier

Now a power amplifier for UHF AMATEUR AND CB radio. A very healthy 25 watts output from virtually any UHF input (from around 300mW or so.) And that could make the difference between being heard and. The amplifier kit is complete to the last nut and bolt — including the same deluxe case used in our UHF amateur transceiver, and its matching power supply. So now you can build a matching amplifier too! Cat K-6314



Short form kit Does not include case



Mixer Preamp

Designed to suit the 300W amp kit, this mixer preamp has 4 inputs with an impedance of 100K - suitable for most microphones, guitars, etc. Ideal also for use with 50W (K-3400) and 100W (K-3442) power amp modules. This unit provides bass, treble and presence control. Instructions supplied.

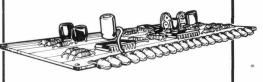
Short form kit: no case, transformer or power supply. Cat K-3035

VCR Theff Alarm



Don't let your VCR become the most talked about item behind the pub! Build this neat little kit and it will scream its head off if anyone tries to make off with your pride and

NOW ONLY



LED TACHO

Don't spend a fortune buying a tachometer - build your own and save! Displays engine speed in an analogue form in an illuminated row of LED's. Instructions included - a great kit!

en you build it yourself!

Earn a Fortune! (or a few cents)

Build the **Busker Amp**

Easy-to-build general purpose microphone/guitar preamp & power amplifier, ready to build into a speaker case for a go-anywhere mini pal

Ideal for the budding buskers in the family. Also fantastic for displays, fetes, rallies, etc.

Includes components, speaker but we leave the case to you (if you want to use away from power point you'll also need a 12V gell cell.

Cat S-3320

Short form kit Does not include case



\$7995

Stereo Enhancer

Here's a great kit for those on a space budget! If your listening area is not exactly stereo quality, the stereo enhancer will 'widen' the sound to make it sound like it's almost designed that way!

Complete kit, including special abs case together with instructions make this one a beauty to put together - and even more of a delight to use.

As described in ETI, March 1985. Cat K-3419



VCR Sound Processor



Unless you're lucky enough to have one of the new hi fi videos, the sound from your VCR is probably pretty pedestrian! Now you can give it a lift with this VCR Sound Processor!

It includes an effective stereo simulator circuit, a 5 band graphic equaliser to make up for the crook audio and your (probably!) equally crook listening room plus noise filtering to get rid of tape hiss and other unwanted high frequency noise. Cat K-3422

\$**49**95



Speed Controller

A completely new circuit offering unbelievable smooth control and torque even at very low rpm. Yes, it's even better than the previous modell New design includes in line plugs and sockets for extra convenience. Suits virtually all 'universal' (brush type) motors: Cat K-3086

\$2195

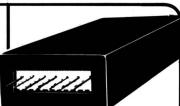
Ultrasonic Movement Detector

The problem with 99% of car alarms is that they cannot prevent the thief who breaks a window and reaches in for the goodles. While this kit won't prevent the window being broken, it will protect your property inside the car. Silent ultrasonic rays detect any movement and trigger the main alarm systems. Cat K-3251

\$**49**95



Bactronics Australia
ULTRASONIC MOVEMENT DETECTOR



Negative Ion Generator

You've heard all about Negative Ion Generators and their benefits, now buy the kit and find out what it's all about. Many commercial units run from the mains, but our kit is safe - it runs on 12V DC, which also means that you can put one in your carl Kit includes exclusive Dick Smith emitter head, power pack and tough moulded plastic case. Cat K-3335

\$4250

Stereo TV Decoder

TV sound can be very high quality - especially now it's being transmitted in stereo. But 99.9% of TV sets can't take advantage of this because they're only equipped for mono sound. And 99.9% of people aren't willing to get rid of a perfectly good colour telly just to get stereo sound!

Especially when a new stereo colour TV can set you back the best part of a tidy bitl Here's the Dick Smith Electronics-low-cost-solution.

Cat K-6325





See page 117 for store addresses

A962/6.85

Arbitrary waveform generator

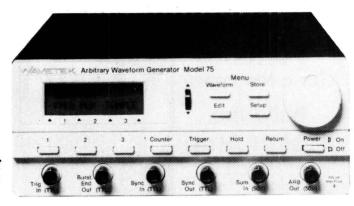
A new arbitrary waveform generator developed by Wavetek of San Diego, USA, has the ability to link a number of waveforms in either series or parallel.

Each waveform has a vertical resolution of 4096 points and a horizontal resolution that is adjustable from two to 8192 points. The waveform memory is broken up into four blocks of 2048 points, so four different waveforms of up to 2048 points can be in memory at any one time. Each of these waveforms can be used independently. Or, adjacent waveforms can be linked. Memory is battery backed, allowing user waveforms to be stored.

The sample period is crystal controlled and adjustable from

500 ns to 50 s, allowing waveform periods of 1 μ s to 113.8 hours. The sample period can also be controlled by an external clock with a period of 500 ns or longer. Waveforms can be stopped and started at any point in the waveform either with an external signal, front panel pushbutton or pre-programmed triggerpoints.

It contains the unusual (and important) feature of 'rubber-band editing', similar to stretching an ordinary rubber band between thumbtacks. On the screen, an electronic drawing pin



is placed at each end of a waveform with the cursor being placed between them. The cursor can be moved either horizontally or vertically, with the waveform following in real time. Thus, with rubberbanding, it is very easy to stretch or compress custom waveforms. Also one cycle of standard waveforms such as sine, havesine, or triangles can be placed between thumbtacks and then modified in amplitude, offset and phase. This powerful editing allows the user to quickly create any waveform directly from the front

An optional RS-232C or GPIB port is available for entering waveform data from an external computer. Because Synch Out is adjustable, more than one unit can be linked in parallel producing waveforms with controllable phase relationships. An additional feature includes a burst counter that allows the counting

panel using only an oscilloscope.

forms, which eliminates the need* for an additional counter when the Model 75 is used for structural and fatigue testing.

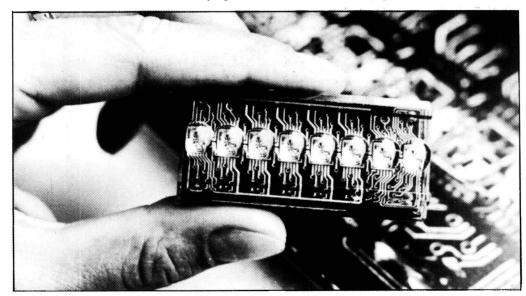
of from one to 1,000,000 wave-

Intelligent LED

Intelligent LED displays that are able to generate complete characters from simple signals have now been diversified to perform additional functions. The new PD 2816 from Siemens

(eight 18-segment elements, 4.1 mm) allows the user to have the characters flash or underlined and to adjust the display intensity. A CMOS circuit stores the program.

The PD 2816's programmable features extend an LED display's vocabulary beyond alphanumeric characters without calling for additional components.



Intensity of emission can be reduced by 50 or 75% so as to downgrade the significance of the information displayed or adapt the brightness to the ambient light conditions. When the display flashes, the memory contents remain intact. The characters only need to be input once and not in the rhythm at which the LEDs light up.

The electronics in the PD 2816 comprises the character generator (ROM), multiplex, timer logic and driver logic, and also the CMOS circuit for the supplementary programmable functions. The 4.1 mm-high characters are enlarged by lenses. Any number of eight-element displays can be cascaded to formlong lines of text.

For more information contact Measurement & Control Division, Electrical Equipment Limited, Unit C, 8 Lyon Park Road, North Ryde, NSW 2113.

Personal development with Macrodynamics

Macrodynamics has just released the fully integrated Microtek Personal Development System.

With in-circuit emulators (MICE II), cross-assemblers and advanced software, it serves as a high-level design tool for hardware development. MPDS supports debug and testing for products based on 8- or 16-bit microprocessors from Intel,

Motorola, Zilog, etc. An extensive software base is provided to simplify and speed product development. This multi-purpose portable tool supports users in the lab, the factory and the field.

For further information contact the Australian distributor Macro Dynamics, Bayswater, Vic. 3153.

STD motherboards

Pro-Log's new 711X Series are four layer motherboards with +5 V and ground planes occupying the centre layers. This virtually eliminates IR drop along the length of the bus with interleaved signal and ground traces and reduces cross-talk. These

features provide a motherboard less susceptible to noise and therefore ideal for higher performance CPU cards.

For further information contact Pro-Log (Australia), PO Box 1, Canterbury, Vic 3126.

New electronic time switch

Energy Measurements has released its newest Time Switch — The EM 28. It has a capacity for 123 separate switching functions or 861 events.

The program base is a yearly function which allows for the programming of specific dates up to one year ahead. This is of advantage in building management where air conditioning plants, lighting and other services are not needed on public holidays etc. The four channel unit has a programmable adjustment for automatic daylight saving time changeover.

Programming is by cursor and all instructions can be recalled, changed or erased individually. There is a manual override switch on all four channels and a battery reserve keeps the EM 28 fully operational during power failures.

Each channel has an inbuilt hour meter and switching functions are on-off and impulse (1 second).

For more information contact Energy Measurement, PO Box 90, Pymble, NSW 2073. (02)449-9910.



BRIEFS

Static solution

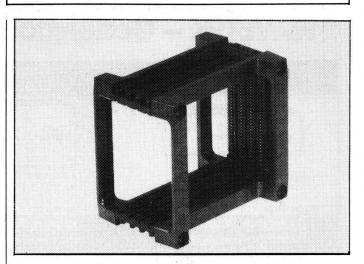
Static can be one of the most annoying disruptive elements in our hot and dry environment when we are dealing with computer work and electronic instruments. It can cause problems ranging from a small "hiccup" in the system, to a complete loss of your program, and even jamming or destruction of components in your system. ZAP! Just like that! Bill Sharpe and Ray Freer, both of Trio Electrix, are fully conversant and exuberant about STATICIDE and its potential for eliminating static problems. To get in touch call at Trio Electrix Pty Ltd, 177 Gilbert Street, Adelaide SA 5000. (08)212-6235.

Breakpoint control

Microtek International has announced a comprehensive breakpoint control unit for all MICE II in-circuit emulators. Its an optional single card pcb, that features sophisticated breakpoint logic. It includes up to 120 new breakpoint constructures for more flexibility in target system debug and development. The BPP also includes external hardware triggering and an execution activity timer. This powerful triggering system helps you to quickly solve the most difficult software and hardware bugs.

Test accessories

Tecnico Electronics has announced its appointment as Australian distributor of instrument test leads, probes and accessories from H.C.K. of West Germany. For further information contact Tecnico Electronics, 11 Waltham Street, Artarmon NSW 2064. (02)439-2200 or Vic (03)542-3260.



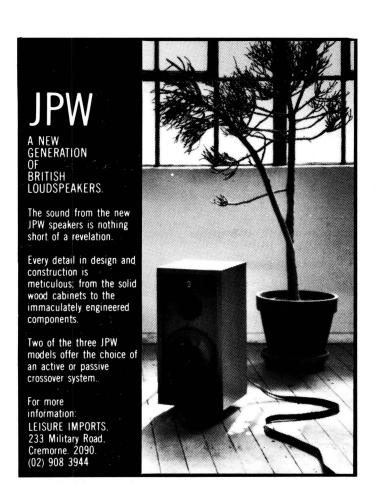
Pulsar racks

Build-A-Rack, from Pulsar Electronics, is a modular bus and card guide system designed for use by research laboratories, specialist electronic engineers and OEM manufacturers.

The systems can be used for any combination from two to 32 slots in each unit. The motherboard contains combinations of 56 pin STD bus slots suitable for S-100, STD and multibus applications.

A typical four card system including bus, eight card guides and locking pins is priced at \$106.

For further product information contact Pulsar Electronics, Lot 2, Melrose Drive, Tullamarine, Vic 3043. Phone (03)330-2555.

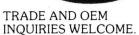


BUILD YOUR OWN SPEAKERS

The superb DYNAUDIO and SCAN-SPEAK drivers from Denmark are now available in Australia. These loudspeaker drivers are used by many superior brand named speakers, some of which sell for up to \$13,000 per pair.

Here is your chance to design and build your own top speakers. If you prefer, you can use the designs and crossover networks we have available. All specifications are available on request, including 'Thiele & Small' parameters for design of bassreflex cabinets.





Sole Australian Distributor:



P.O. Box 242, Hawthorn, 3122. Ph. (03) 819 5352

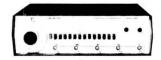
Wholesalers:

Perth: Sampson Agencies (09) 364 9516 Cairns: Island Agencies (070) 93 7462

Brisbane: Qld. Stereo/Visual Supply (07) 265 7945

WAVETEK – Generators for <u>every</u> application

Low Cost with Trigger & Gate



- 20V p-p output
- 0.004 Hz to 4 MHz frequency range
- DC offset with calibrated zero

Model 1824

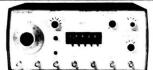
Combined Synthesizer/ Function Generator



- Lin/Log Sweep plus AM/FM
- Pulse width and transition time control
- Independent pulse width and rate

Model 166:

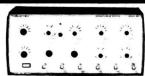
Stabilized with Digital Readout



- 4½ digit or 1000:1 dial control
- −70dB spurious
- 0.005% frequency accuracy

Model 171:

50 MHz Pulse/ Function Generator



- Variable rise and fall times
- Single, double and pulse burst
- 20V output

Model 801:

50 MHz Pulse Generator

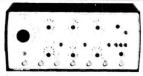


- 100 uHz to 11 MHz
- Crystal stabilized to 0.09%
- Trigger, gate and sweep (Model 22)

Model 21:

20 MHz Sweep/ Modulation Generator

Model 22:



- Two generators in one for AM/FM/sweep
- Easy setup of modulation
- 30V p-p output

Model 193:



SCIENTIFIC DEVICES AUSTRALIA PTY LTD

2 JACKS ROAD, SOUTH OAKLEIGH, VICTORIA, 3167. PHONE: 579 3622 31 HALSEY ROAD, ELIZABETH EAST, S.A. 5112. PHONE: 255 6575 559A WILLOUGHBY RD, WILLOUGHBY 2068. PHONE: 95 2064

NOW MOHAMMED NEED NOT GO TO THE MOUNTAIN...

Imagine! A computer that's powerful enough to run your business . . . yet small enough to take home with you. That's the Bondwell 14 Portable.

it has all you need to run a business – yet costs a fraction of the price of other computers.



That's why it's the success story of 1985!

In just a few short months, the Bondwell 14 portable has become our largest selling business computer. It offers performance and reliability far exceeding its low price tag. Even first glance will tell you that the Bondwell 14 portable is no ordinary computer!

You'll see:

- 128K RAM on board!
- Twin 360K disk drives!
- 220mm amber-screen monitor!
- Twin RS-232 serial ports!
- Centronics parallel port!
- External video monitor port!
- Ergonomically designed adjustable keyboard!
- PLUS a package of famous Micropro 'Star' series software valued at over \$1200: Wordstar word processing, Calcstar spreadsheet, Datastar information handling and Reportstar report preparation. AND if that's not enough, a host of CP/M utilities including a speech synthesiser! Yes, this is all included FREE with your Bondwell 14 portable.

And just in case your business needs other specialised software, you have one of the biggest 'libraries' in the world at your disposal: the Bondwell 14 portable operates under the world-standard CP/M system. (And it's the latest, most powerful version – Vs 3.0.)

With the huge number of programs written for this system, you'll find the one you require. And the Bondwell 14 portable will read disk files from many other computers – including the IBM PC (& compatibles), Osborne, Kaypro and Spectravideo!

Weighing in at just 12kg and measuring just a little larger than an electric typewriter, the Bondwell 14 is truly portable. Take your Bondwell 14 to where the job is: Mohammed need no longer go to the mountain,

Your business survival depends on your making the correct decisions. Decide on the Bondwell 14 portable. And survive!

Want to know more? Call in to your nearest Dick Smith Electronics Computerstop for a test drive. Ask for a copy of the Bondwell 14 brochure. And then get your own Bondwell 14!

Bondwell Computers: exclusive to Dick Smith Electronics.

***** \$2495

Or \$247 deposit and \$19.85 weekly over 48 months to approved purchasers.

Dick Smith Electronics Pty Ltd

COMPUTERSTOPS

Your one stop computer shop at your nearest Dick Smith Electronics centre.









COMPONENTS * * * * * * * * * * Stereo Mixers at **Low Import Price**

ATTENTION—Social Clubs, Schools, Churchs, Disco Operators, Entertainers, Hotels, Night Clubs and sporting Bodies. With Altronics low prices—here is your opportunity to install one of these outstanding sound control mixers. Both models include microphone "Soundover" facility—making either ideal for live entertainment use.

Stereo Audio Mixer



A 2550 \$125.00

240V Mains Operated

This brilliant little mixing console is absolutely packed with features. Allows blending of Microphone, two Phono inputs and either two Tape or Turner inputs • Right and left VU meters • Separate Bass and Treble controls • 5 slide level controls • Fader control between Phono pickups for professional cueing . Headphone monitor switch . Talkover facility.

SPECIFICATIONS:

JETSERVICE DELIVER

NEXT

 Input Mic 0.5mV 600 Ohms Phono 3mV 50K Ohms Tape/Tuner 150mV 100K Ohms • Output 250mV • Frequency Response 20Hz to 20Hz (plus or minus 1db) • Tone Control (Treble) 10KHz (plus or minus 12b) • Tone Control (Bass) 100Hz (plus or minus 12db) • Distortion Less than 0.07% • S/N Ratio More than 60db • Headphone Impedance 4—6 Ohms • Discording 218 (1) × 247 (MV) × 65 Dimensions 318 (L) x 217 (W) x 85 (H)

Pro-Quality Stereo Mixing Console

240V Mains Operated



AMAZING VALUE

\$399.00 A 2570

Our sophisticated 'NEW' Audio Mixing Console is ideal for 'live' recording
• PA mixing • Fantastic Tape recordings • Even Stereo/Mono VCR recording. A truly professional deck that features separate R/L 5 band graphic equalisers • Echo and Peak LED level indicators • Talkover facility
• Separate H/Phone level control • Patch switch bank • Individual microphone, Phono 1 Phone 2, Aux/Line 1, Aux/Line 2, and Master slide level controls. — Blend up to two magnetic or crystal turntables, two tape decks or tuners and two microphones all at once!!

SPECIFICATIONS:

- Input Mic 1—0.5mV 600 Ohms Mic 2—0.5mV 600 Ohms Mic 2—0.5mV 600 Ohms (low imp.) 2.5mV 10K Ohms (low imp.) Phono 1 & 2 (Mag) 3mV 50K Ohms Phone 1 & 2 (Cry) 150mV 100K Ohms Tape/Tuner 1 & 2 150mV 100K Ohms Equaliser 5 frequency bands—60Hz, 250Hz, 1KHz, 4KHz, 12KHz—Boost Cut range-plus or minus 12db @ Centre frequency. Output 1.5V/0.775V (Selectable) Frequency Response 20Hz to 20KHz plus or minus 1db Distortion Less than 0.05% S/N Ratio More than 50db
- Headphone Impedance 4—16 Ohms Echo B.B.D.System Delay Time
 30—200mS Echo Repeat Control Delay Time Control Dimensions 480 (L) x 240 (W) x 110 (H)



Build These Great EA Projects

Save a bundle on the price you would otherwise pay for a commercial equivalent.

FREQUENCY COUNTER

Measures to 50MHz (to 500MHz with optional Prescaler).





UNBELIEVABLE 0.005% ACCURACY

• Frequency and Period measurement to 500MHz (with optional prescaler) High input sensitivity. Professional unit at a fraction of the cost of built up units. • IC sockets provided throughout • Low age rate 10.000MHz XTAL • Quality ABS plastic case with deluxe front panel • Specified LSI.

K 2500**\$129.50**

\$29.50 K 2501 **PRESCALER**

K 2502 **DECIMAL POINT**

FUNCTION FUNCTION With Digital Display sine, triangle and GENERATOR square wave outputs 15Hz—250KHz.



The most essential piece of test gear (second only to a good multimeter) on any hobbyist's bench is some kind of audio signal generator.

A truly versatile unit at a bargain price.

• 4 digit frequency readout (eliminates tiresome dial calibration) — typical accuracy +2% • 3 overlapping ranges x1, x10, x100 • 600 Ohm Nominal Output — continously variable 3MV — 2.5V P-P • Distortion—sinewave : less than 0.7% @ 1kHz • Linearity—triangle wave : better than 1% • 1kHz • Squarewave rise time— 6V/uS maximum output • Amplitude stability better than 0.1db on all ranges.

With the exception of the display all components mount on a single PCB making this kit suitable for all constructors.

DIGITAL CAPACITANCE METER 1 pf to 99.99 uf in 3 ranges



K 2521 \$59.00

This superb Test Instrument Kit now compliments our top selling Digital Inis superb lest instrument kit now compliments our top selling Digital Frequency Counter and Function Generator Project Kit. Electronics Australia Project. Measures capacitance of both polarized and non-polarized capacitors from 1 picofarad to 99.99 microfarads in 3 ranges. Check values of unmarked capacitors, especially those little trimmers that are never coded. Select precise values for filters and timing networks with ease.

EXCLUSIVE TO ALTRONICS

Each Kit includes precision measured capacitors for accurate calibration

PHONE YOUR ORDER — ALTRONICS TOLL FREE 008 • 999 • 007

JETSERVICE

STATE OF THE ART

The Avtek MultiModem

a breakthrough in low cost modem design Using state-of-the-art VLSI integrated circuitry, the Avtek MultiModem provides the highest standards of reliability for data communications on public phone lines. Digital signal processing is used to achieve functions normally requiring analogue filters.



MULTIMODEM NEVER REQUIRES ADJUSTMENT

MULTIMODEM WORKS RELIABLY ON LINES WHERE OTHER MODEMS CAN'T FUNCTION Its digital filters are much sharper than on conventional modems. Line interference is screened out. You get error free data transfer, even on very noisy lines.

MULTISTANDARD OPERATION

CCITT and Bell Duplex and Half Duplex

AUTO ANSWER OPTION (MODEL D 1205)

PHONE YOUR ORDER — ALTRONICS TOLL FREE 008 • 999 • 007

Autoanswer is the ability of computer/modem to receive when the phone rings. Some computer/software combinations do this. MultiModem offers the alternative for computers without this facility—hardware autoanswer. Leave your computer waiting for information.

TEST FUNCTIONS

DIG: This function enables the user to test the modem's operation over a line, testing both modem and line.
ANL: Provides testing of computer, software,

cabling and modem

SPECIFICATIONS

Data CCITT V.21 & V.23 Bell 16 Standards:

300, 600 & Data Rates: Backward

Channel:75 BPS in conjunction with

Interface: CCITT V.24 Power

Requirements: 240 VAC Power drain TWO MODELS \$349.00

D 1200 (Standard)

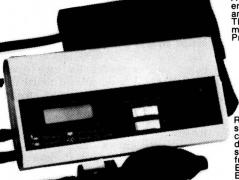
D 1205 with auto answer

\$389.00

BLOOD PRESSURE & HEART RATE MONITOR

Why Risk Unnecessary Heart Attack?

A simple (take the reading yourself) periodic check of your blood pressure and pulse provides an "inward look" into a vital aspect of your bodily health. Heart desease strikes down many people in their early 40's (or even 30's). The tradgedy remains that had such victims been alerted, remedial medical, physical and dietary action could have been prescribed to avoid illness and in many cases restore full bodily health.



A Superb Gift for the dedicated fitness enthusiast Absolutely essential for those over 40 and concerned with their health, or on Fitness Therapy. Use this easy to operate Monitor to measure your pulse (or heart rate) and Blood Pressure.

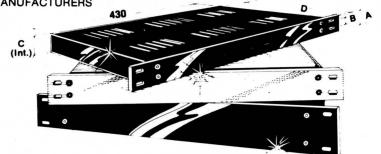
DON'T PAY **\$150** X 3055

Now Only \$89

Remember high blood pressure is in itself symptomless and the usual forerunner to future chronic heart disease. Features include "error" display warning of incorrect use. Handbook supplied will enable anyone in your family to be fully conversant with this monitor in minutes. Easy to read display of Systolic and Diastolic Blood Pressure and Pulse Rate.

PROFESSIONAL SERIES RACK CABINETS

NOW YOUR PREAMPS, AMPS, CONTROL MODULES MONITOR PANELS ETC. CAN LOOK EVERY BIT AS GOOD AS TECHNICS, NAKAMICHI AND OTHER TOP **MANUFACTURERS**



FEATURES:—• These beautifully crafted rack cabinet boxes will give your equipment a real lst class appearance • Aluminium construction with removable top and bottom steel cover panels • All dimensioning conforms to the International Standard • Natural or Black finish • Ventilated lid • Deluxe finish front panel • Individually cartoned • Supplied in Flat Pack Form—Easily assembled in minutes—Side Elevations:—• D= 254mm C (Internal Chassis Height) • B (Mounting Bolt Centres).

SIX NATURAL AND BLACK FINISH MODELS

The Black or Natural finish cabinets are each available in 44mm, 88mm or 132mm high models. Mounting hole centres conform exactly to International Racking Specifications both vertically and horizontally

Cat. No.	Finish	A	В	С	ea.	5+
H 0401	Natural	44	34	38	\$49.50	\$47.50
H 0402	Natural	88	57	82	\$59.50	\$56.00
H 0403	Natural	132	89	126	\$64.75	\$61.50
H 0411	Black	44	34	38	\$49.50	\$47.50
H 0412	Black	88	57	82	\$59.50	\$56.00
H 0413	Black	132	89	126	\$64.75	\$61.50

105 STIRLING STREET, PERTH FOR INSTANT SERVICE PHONE ORDER TOLL FREE 008 999 007

PERTH METRO AND A/HRS ORDERING SERVICE (09) 328 1599

ALL MAIL ORDERS Box 8280, Stirling St. Perth WA 6000

FOR NEXT DAY JETSERVICE DELIVERY

PACKING AND DELIVERY CHARGE 53.00 DELIVERY AUSTRALIA WIDE -We ass your order the day received and despace via. Australia Post. Allow approx. 7 day from day you post order to when you recall goods. Weight limited 10Kgs.

\$5.00, OF TRINIGHT JETSERVICE - We process your order the day received and despatch via overlight retservice Courier for delivery next day Couriery areas please allow additional 24-48 hours - Weight limit 3Kgs.

\$10.10 HEAVY HEAVY SERVICE - All orders of 10kgs. or more must travel Express Road - Please allow 7 days for delivery.

INSURANCE — As with virtually every other Australian supplier, we send goods at consignees risk. Should you require comprehensive insurance cover against loss of damage please add 1% to order value (minimum damage).

damage please add 1% to order value (minimum charge \$1). When phone ordering please request "Insurance".

TOLL FREE PHONE ORDER - Bankcard Holders can phone order toll free up to 6pm Eastern Standard Time. Remember with our Overnight Jetservice we deliver next day.

ALTRONICS RESELLERS

Wanted in all Areas of Australia-Phone Steve Wroblewski on (09) 381 7233 for Details

١	NSW
١	CITY
1	David Reid Electronics 267 1385 Jaycar 267 1614
١	CARLINGFORD
1	Jaycar872 4444 CONCORD
1	Jaycar745 3077 GORE HILL
١	Jaycar439 4799 HURSTVILLE
1	Jaycar570 7000 LEWISHAM
1	PrePak
١	Electronics 569 9770 08COUNTRY
١	ALBURY Webb's
١	Electronics 25 4066 BATHURST
١	
1	Shop
1	Crystal TV 4803
١	COFFS HARBOUR Coffs Habour
١	Electronics 52 5684 GOSFORD
1	T
1	Electronics 24 7246 KURRI KURRI Kurri Electronics 37 2141
١	NEWCASTLE
١	D.G.E.Systems 69 1625 George Brown &
١	Company 69 6399 NOWRA
١	Southern
1	Communications 21 4011 ORANGE
1	MW Electronics 626 491 PORT MACQUARIE
1	Hall of
	RAYMOND TERRACE
1	Alback Electronics 87 3419 RICHMOND Vector
1	Vector
	Electronics 78 4277 TAMWORTH Landlink
١	Landlink
1	Communications 65 4622 TENTERFIELD
1	Nathan Ross 36 2204 TOUKLEY
١	TES Electronics . 96 4144 WINDANG
١	Madjenk
	Electronics 96 5066 WINDSOR
	M & E Electronics Communications 77 5935 WOLLONGONG
	WOLLONGONG Newtek
	Electronics 27 1620
	Vimcom Electronics 28 4400
	ACT

W	QUEENSLAND	VICTORIA
ГҮ	CITY	CITY
id Reid	Delsound P/L 2296155	Active
ctronics 267 1385	Jaycar393 0777	Electronics 602 3499
car267 1614	SÚBURBAN	All Electronic
UBURBAN	FORTITUDE VALLEY	Components 662 3506
RLINGFORD	McGraths	MaGraths
car872 4444	Electronics 832 3944	Electronics 347 1122
NCORD 745 2077	St.Lucia	SUBURBAN
ear745 3077	Electronics 523547	BENTLEIGH
car439 4799	PADDINGTON	Absolute
RSTVILLE	Jacques	Electronics 557 3971
car570 7000	Electronics 369 8594 SALISBURY	BOX HILL SOUTH
VISHAM	Colourview	Eastern
Pak	Wholesale 2753188	Communications 288 3107
ctronics 569 9770	SLACKS CREEK	CHELTENHAM
COUNTRY	David Hall	Talking
BURY	Electronics 2088808	Electronics 550 2386
b's	TOOWONG	DONCASTER
ctronics 25 4066	ECQ Technics 3710879	Clipstone
THURST	COUNTRY	Electronics 84 2868
Electronics 21 4421	CAIRNS	FOOTSCRAY
OKEN HILL	Thompson Instrument	Acron
stal TV 4803	Services512404 BUNDABERG	Electronics689 1911
FFS HARBOUR		SOUTH CROYDEN
s Habour	PM Electronics 728 272 GLADSTONE	Truscott
ctronics 52 5684	Purley Electronics 724321	Electronics 723 3860
SFORD	NAMBOUR	COUNTRY
iorrows	Nambour	BENDIGO
ctronics 24 7246	Electronics 411604	K.C.Johnson 41 1411
RRI KURRI	PALM BEACH	MORWELL
Electronics 37 2141	The Electronic	Morwell
E.Systems 69 1625	Centre 341248	Electronics 34 6133
rge Brown &	ROCKHAMPTON Purley Electronics . 21058	ROBINVALE
mpany 69 6399	TOOWOOMBA	John Mason
WRA	Hunts Electronics . 329677	Electronics 26 3643 SHEPPARTON
thern	TOWNSVILLE	GV Electronics 21 8866
mmunications 21 4011	Solex722015	GV Electronics E1 0000
ANGE Electronics 626 491		•
RT MACQUARIE	SA -	
of	CITY	
ctronics 83 7440	Force Electronic 212 2672	COLUMN
MOND TERRACE	Protronics 2123111	COUNTRY
ck	Gerard & Goodman223222	ALBANY
ctronics 87 3419	SUBURBAN .	BP Electronics 41 2681
HMOND	BRIGHTON	ESPERANCE
or ctronics 78 4277	Brighton	Esperance
WORTH	CHRISTIES BEACH	Communications 71 3344
flink	Force	GERALDTON
munications 65 4622	Electronics 382 3366	K.B.Electronics
ITERFIELD	PROSPECT	& Marine 21 2176
an Ross 36 2204	Jensen	KALGOORLIE
JKLEY	Electronics 269 4744	Todays
Electronics . 96 4144	REYNELLA	Electronics 21 2777
DANG	Force	MANDURAH
enk etronics 96 5066	Electronics 381 2824	Kentronics 35 3227
DSOR	COUNTRY	WYALKATCHEM
E Electronics	MT.GAMBIER	D & J Pease 81 1132
munications 77 5935	South East Electronics 250 034	
LLONGONG	PT.LINCOLN	
tek	West Coast	
ctronics 27 1620	Elect Supplies 82 5802	
om	WHYALLA	

WHYALLA HOBART D & I Ager DARWIN . 34 7877 Ventronics 81 349 ALICE SPRINGS LAUNCESTON . 31 6533 Ascom Electronics 52 1713 LEGANA

PHONE YOUR ORDER — ALTRONICS TOLL FREE 008 • 999 • 007

MAKING YOUR OWN PRINTED CIRCUIT BOARDS

Ian Thomas

The cheapest and most simple printed circuit board is the one you buy with or for your ETI project — ready made. With this procedure and a little practice you will find it easy to make boards for your own circuits.

IT'S ONE THING to read about all those 'you beaut' projects but quite another to actually build one up. Or perhaps you have ideas about what seems an excellent project but never find anything like it in the magazines (we do our best but . . .). The clever thing to do is to make it yourself. Making a complete printed circuit right from the original idea to the final unit isn't as complicated as it seems and all the necessary ingredients are readily available.

Breadboards

The place to start the whole business is the original diagram. If you haven't got a complete and detailed circuit diagram you aren't really ready to start making hardware and more development is needed. If you're starting from a magazine article then no problem, but if you're designing your own circuit then you must first try out your circuit design with what is politely called a "breadboard" (for reasons I've never really understood) or, less politely but more descriptively, a rat's nest.

Plug-in type breadboards can be bought from almost any supply house and vary considerably in both price and quality. A good hint if you're going to buy one is first to try all different component lead sizes in the breadboard holes to make sure they're held firmly by the sockets. The cheap and nasty ones tend to not hold the finer leads and will drive you crazy by falling out while you use them.

Once you've got your circuit working,

draw the circuit from the breadboard, tracing out each component as you draw it. You'd be amazed how often things aren't exactly as you think they are! Even at this stage it may be desirable to do a little more work in refining the design.

When you're tinkering to get things working you may inadvertently do things that are inelegant (or downright wrong — you'd be amazed how easy it is to get things working only to raise a fierce blister on a transistor because you didn't notice it was dissipating a watt or so!).

After you're satisfied that the circuit diagram is what you've got and what you've got is what you want the next thing to do is redraw the diagram as neatly as possible. Make the lines between components as short as you can get them and have as few lines crossing over each other as possible. This isn't just good documentation; it forms the basis of the printed circuit layout.

If you start the board layout following a neat diagram the layout tends to go pretty easily but if you start with a mess the board will turn out worse! It's a lot easier to have lines crossing each other on paper than copper tracks on fibreglass.

The next step is to decide exactly where you want to mount the board so that you can see how much space you have. Now that you've got the circuit diagram you can make a list of all components and tally up the board area necessary to fit them. This list will normally consist of so many resistors (value doesn't matter), so many

transistors, so many capacitors this size, so many that size and so on. Every component must be used including the power supply bypass capacitors you left out. That must be one of the most common sources of trouble in getting circuits to work. The final list will have every component in sections according to size.

How big a pc board?

Next you have to work out how much board area is needed for each type of component. A good rule of thumb is to allow 0.05 to 0.1 inch greater than the maximum size of the component. For example, your ordinary common or garden resistor has a body about 0.1" in diameter and mounts on 0.4" centre holes. The board area to allow for is therefore 0.15 x 0.5 or 0.075 square inches.

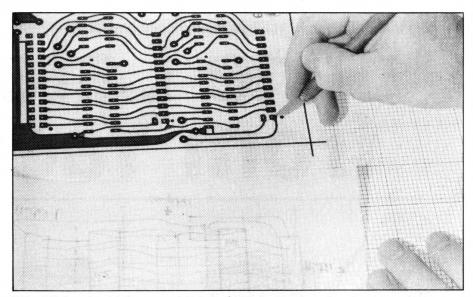
It isn't the object at this stage to allow for the space needed for interconnection but only to find the absolute minimum board area needed.

On your list tally up the areas of all the components and this is the board area you'll need if you could achieve a perfect layout. At this stage you must also consider how you intend to mount the board as mounting holes also use board area — make the mounting holes another item on your list.

Next compare the needed area with the area you have available in your box or whatever. A very good guide to the difficulty of the layout you will have to do is called the packing density of the board. The packing density is the ratio of the board area needed to the total available area usually given as a percentage. For example if your list says you need 4.82 square inches and the total available area is 3" x 2" then the packing density needed

 $\frac{4.82}{3 \times 2}$ = 0.803 or 80%

This packing density could be done but would be rather difficult. As a general



Twice full size artwork being prepared. Note the tenth-inch grid and pencil rough.

rule less than 50% is pretty easy, less than 75% needs a little care, less than 90% needs a *lot* of fiddling and rearranging and greater than 90% means good luck!! (forget it).

If the packing density works out then you're in a position to start blocking out the board layout. Buy some tenth-inch grid graph paper (I know we've all supposed to have gone metric but *all* pin spacing is given in tenths of an inch and 0.1'' = 2.54 mm and the .04 mm can add up horribly) and draw in the outline of the final board you want.

If you're only going to make one board for yourself and you don't have too high a packing density the outline can be the same size as the final board. However if you want a really neat job then the outline should be exactly twice the size of the final board.

Artwork size

Doing the layout at twice full size means that any inaccuracies in the layout and the printed circuit artwork that comes from the layout are reduced to half size when the twice full size artwork is photographically reduced to normal size. This doesn't excuse rough work; it just makes finer detail work possible. Almost all commercial artworks are taped at at least two to one and sometimes four to one if special accuracy is required.

For the hobbyist there are two disadvantages in generating artwork at twice full size. The first is that the artwork has to be photographically reduced to final size after taping is completed. This means you have to take your artwork around to an industrial photographer (there are plenty around) who will photograph your masterpiece so the negative out of the camera is exactly the right final size.

If you're going to use precoated printed board material (more of this later) then this is all you need but if you want to put your own resist on the board then you must ask him to make a contact positive of the reduced negative.

Both these cost money but not as much as you may think. To give an example, the electronic scales that appeared in June and July ETI last year cost me \$18 for reduction and positives. There was no way the artwork could have been done at full size so I had no choice. Even if they could have I would probably still have gone to twice full size originals.

Probably the greatest disadvantage to using twice full size is that you have to find time to go out and have the photography done. If you're beavering away building your technological masterpiece at 2 am on Sunday morning you probably won't want to stop for the weekend to get reductions done. If the artwork is full size you can carry on and the whole process can be done at home.

A second disadvantage with twice full size artwork is that you can't actually place the components on the layout to see if they'll fit. But if you haven't done a lot of artwork then single size is an invaluable way to make sure you aren't asking the impossible. Stencils can be bought with the outlines of most components twice full size on them to act as layout aids (Bishop Graphics Cat # EZ3367 & EZ3368) but it's not quite the same as the actual IC or transistor.

Whatever size you decide to use there are a few essential purchases you must make before you start. The first is the plastic draughting film that is used to make the artwork and the other is the artwork stick-on pads and tape to actually generate the artwork.

If you intend to use single size artwork then you'll need some 0.1" diameter pads, a few 0.2" pads for terminations, some 16 pin IC pads (get the 16 pin ones only and cut them down for 14 or 8 pin IC's) and a few different thickness tapes; say .040" and 0.075" for starters. The tape is specially made for artwork generation and is

completely opaque to light. It can also be bent (it's sort of like black masking tape) to form curved tracks on the artwork but more of this later.

Get yourself a pencil, rubber (a good one as you'll be making a lot of changes) and all the components you intend to finally use and you're ready to start on the real layout. Even if you're doing twice full size artwork it's still essential to hold components on the graph paper to see how they fit sometimes.

Start by drawing in the terminal pads so all the leads come off the board in a nice neat group. Then start drawing in the components in more or less the same pattern as they appear in your neat circuit diagram. This means the components that connect to terminal pads lie near them.

In order to make things look neat and professional there are a few golden rules in placing components. They are:

- ☐ All ICs must be oriented the same way with pin 1 pointing to the same corner of the board. If you turn some of the ICs 180° then it's a cert you (or someone else) will put the IC in back to front and destroy it! Never ever put ICs in at random 'convenient' angles—it looks like a mess and writes across your layout in words of fire "this was done by an amateur".
- ☐ Resistors should also be put in only parallel to the sides of the board for much the same reasons as above. Also if you orient them at odd angles then you're bound to waste space on the board. The same applies to capacitors and diodes.
- ☐ Transistors and vertically mounted capacitors can be oriented any way so long as their pins fall on the 0.1" grid of the graph paper.

A way of getting things started is to mentally divide the circuit up into small blocks and then proceed to lay out the circuit block by block so the interconnections between the blocks fall next to each other.

The Latest from Yaesu!



Economy 70cm

Value & reliability - with the latest in features! That's the new FT-703 hand held. Tiny size: but what a performer: even has VOX with optional headset! Cat D-3508

\$479



New 2m mobiles, Too!

Want economy? Try the new FT207R. Want power? Try the new FT207RH. You get the choice - up to an amazing 45W output (Yasesu's new ductflow cooling makes it all possible!) Both have 10 memories, dual VFO's plus all the new goodies that make 2 metres fun again!

FT270R (25/3W) Cat D-3515

FT270RH (45/5W) Cat D-3517 \$699 \$649



Mobile 70cm

Full 10 watts output on 70: two 4-bit microprocessors make everything so easy!

And it's small enough to go anywhere. Features a brilliant display for extra road safety - and with fast/ slow band scanning, it's great, mate! Cat D-3505

\$449



Real performance in a hand-held. Push-button keypad gives you real control; add the battery pack you want for the output you want! Cat D-3509

10.8V Battery Pack Cat D-3506 \$79 12V Battery Pack Cat D-3507 \$89

\$499

Battery Not Inc.



FRV-8800 VHF Frequency Conv Fits right inside case - complete with

its own telescopic antenna. Frequency range 118-174MHz Cat D-2823 \$149

FRA-7700 Active Antenna

Great for flat dwellers! No need for an outside antenna and preamp will pull in stations you didn't think possible! Cat D-2845 \$89.50

Cat D-2845 \$89.5 FRT-770 Antenna Coupler

Ensures best performance from all types of antennas. A must if your antenna is not low impedance. Cat D-2843

FRG-8800 DC Kit

Allows operation of your FRG-8800 on 12V DC. Great for field operation, monitoring, etc. Cat D-2822 \$2.50



FRG-8800: All band all mode

And all singing, all dancing. Amazing performance in Yaesu's new masterpiece, the FRG-8800 receiver. Choice of two models, both featuring the very latest in receiver technology.

- 150kHz-30MHz coverage (FRG-8800)
- Fully CAT compatible (computer aided transceiver)
 Provision for VHF converter inside
- the receiver!
 10 memory channels inbuilt (noth-
- 10 memory channels inbuilt (nothing more to buy!)

And much, much more. Ask for a free FRG-8800 brochure at your nearest Dick Smith Electronics store. FRG-8800 (150kHz-30MHz)

Cat D- 2820 \$799

FRG-8800SW (2MHz-30MHz)
Cat D -2821 **\$749**VHF converter to suit (118-174MHz)
Cat D-2823 **\$149**



2M/70cm FT2700RH

Versatility: both hands in a set so small you wouldn't believe it! Full duplexing, twin VFO's, tenmemories ...whatever you want, the 2700 has got!

It features dual independent front ends, dual local synthesisers, dual IF's and transmitter rf stages to make sure you really do get the best of both worlds. And it even speaks to you: add the optional voice synthesiser and it actually tells you which frequency you're on. Hows that!!!

- 25 watts continous on both bands
- two 4 bit CPU's for complete control
- Amazingly tiny size: just 150 × 168 × 50!!!

× 50!!! at D-3515 \$ **945**

The best from



All these items available from your nearest Dick Smith Store.

A963/6.85

Subscribe to Electronics Today now, and receive a 20-watt soldering iron worth \$9.95

ABSOLUTELY FREE!

Right now is certainly the best time to take out a 12-month subscription to Electronics Today. You'll not only be ensuring that you receive each copy regularly each month, delivered direct to you, but you'll also receive a bonus gift: a free 'Dick Smith' soldering iron suitable for the electronics hobbyist, home handyman or technician. But don't delay — this offer is limited.

Australia's dynamic electronics monthly!

Electronics Today is your key to the exciting world of modern electronics — whether you're a professional, an enthusiast or an interested consumer. Electronics Today provides you with news and analysis of the latest developments, authoritative test reports and reviews of new equipment, down-to-earth information on electronics in theory and practice, and well-engineered construction projects.

Electronics Today is also written right here in Australia, so you know that it really does cover the local electronics scene.

Electronics Today Subscription Offer

YES!

Please send me one full year (12 issues) of Electronics Today, delivered to my home, PLUS my free Dick Smith soldering iron at the special offer price of just \$27.00

\$27.00
NAME: JOB/TITLE:
ADDRESS:
POSTCODE: ORGANISATION:
Please tick box to indicate method of payment:
Cheque*/Money Order* American Express Bankcard Mastercard
*Please make cheques and money orders payable to the Federal Publishing Company Pty Ltd. Credit Card No.
Card Expiry Date: Signature:

(Unsigned orders cannot be accepted)

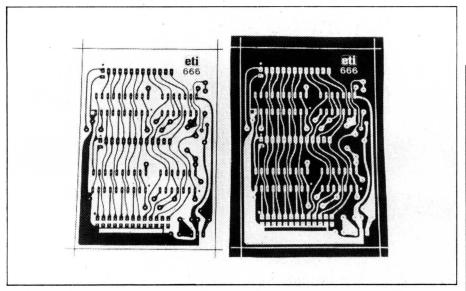
The 'Dick Smith' lightweight 20-watt iron is ideal for most general soldering work. It features interchangeable screw-in tips, a two-metre mains cord with moulded-on plug for safety and durability, and is fully S.E.C. tested and approved. It comes fitted with a plated conical tip, suitable for most general soldering. Normally this quality iron sells for \$9.95 — but currently we're offering it to you FREE with each 12-month subscription to Electronics Today!

> Just \$**27**.00

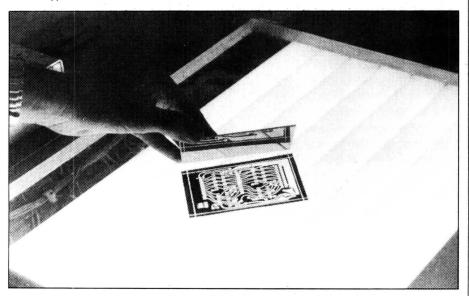
That's a \$3 saving on our regular 12-month subscription rate!

So don't delay — subscribe now in this issue!

Allow 4-6 weeks for delivery of first issue and soldering iron.



Positive or negative? You can tell that the one on the left is positive because the black on the film looks like the copper tracks on the board.



Exposing the resist. With precoated board, simply unwrap in dimly lit artificial light to prepare the surface for exposure.

When a block contains say four or five resistors it's often easy to draw them in side by side with the minimum 0.15" spacing between them then connect them together. Usually the whole group can be connected without moving any component at all or at most the spacing between two resistors may have to be increased to 0.2" to allow two tracks between the pads. The 0.15" spacing only allows clearance for one track between the pads.

The transistor of IC that's associated with the group of resistors can be placed right next to them and connected easily. A strong word of warning must be given — always draw in the power supply lines as you go along and make sure that power supply bypass capacitors go in next to the ICs or transistors that need them. It's no good to try and bypass an IC supply line from half way across the board. A good rule is to put a 10 nF capacitor right next

to every IC on the board or at the very least every three ICs. This probably adds a dollar or so to the cost of the board but is much cheaper than spending hours trying to get things to work when you have half a dozen little oscillators whirring away.

Another most important point is to make your earth track big and short. Even if your circuit is audio or only dc the transistors and ICs don't know this. They still have gain up to many megahertz and if your earthing and/or bypassing is no good they may oscillate.

In your neat circuit diagram you probably have one earth line drawn along the bottom of the page. Try and preserve this as one earth about 0.2" wide on the board with all parts of the circuit that need it tied back to this track. All bypass capacitors should also connect directly to this track without long straggly connecting

tracks. If you've sufficient space it's a good idea to have a border of earth about 1/2" wide all around the board but that's often a luxury physical constraints won't allow.

Signal lines can be allowed to wander around a bit and power supply lines, so long as they're properly bypassed, can wander even more but the earth must not. Keep on adding in blocks of your circuit diagram until you've got it all in including the mandatory large electrolytic capacitor across the supply terminals.

Then, when you reckon it's all done have a look and see if you can reroute tracks to tidy things up. Once you've actually got the whole thing down on paper it's usually pretty easy to see changes that will improve it a lot.

If you want a really pukka job you'll almost certainly have to work the layout down a bit. Even the pros who do this sort of thing for a living still have to rework part of their layouts (apart from one bloke I know but he's a genius with a mental flair for visualising these things!).

Finally when you're really happy that every component on the board is connected up correctly and all the components are drawn in so they don't touch each other (or worse cross over each other!) you're ready to start making the actual artwork that will be turned into copper on fibreglass. This is where you really start to make the board and this is where you find the worst errors in your layout.

Making the artwork

The artwork is taped up on plastic draughting film that can be bought from the same place you bought the artwork aids. There are two sorts available; one is just plain translucent film and the other has very faint tenth-inch grid lines printed on it.

If you get the plain film then you'll have to stick it down on some tenth-inch graph paper. Use small pieces of masking tape on all four corners and make sure you can see through the film to the grid. If you use the film with a grid on it already then it can be worked on over a plain white sheet of paper and it isn't necessary to stick it down. Either way you should have a sheet of film with a grid easily visible on it.

Start by sticking down all the pads of your layout. Taping is done using a small penknife or, more usually, an exacto knife. Exacto knives can be bought from the same place as all the other artwork aids and have many other uses as well (such as modifying copper tracks on the final board). I personally use surgical scalpels which have long, easily held handles but anything with a small blade will do.

STARTING ELECTRONICS 5

To lay down pads slip the tip of the blade under the edge of the pad and peel it off the backing sheet. The knife is normally held in three fingers of one hand leaving the forefinger and thumb free. When the tip of the blade is just under the pad the forefinger is placed over the tip of the blade and the pad to hold it firmly while the pad is peeled off.

The pad is then carefully aligned over the grid on the plastic film and the pad firmly pressed down on the film so the crossed lines on the grid are still visible in the hole in the pad. If you're putting down IC pads you must line up all 14 or 16 pads correctly. It looks terrible to have an IC drawing to see where they should go. You'll have to count off grid lines to locate the position of some pads but others simply lie side by side.

Keep on making checks to make sure you haven't slipped a grid line or so by holding the artwork being taped and your original layout together up to the light so both are visible over each other. Any errors will be immediately obvious. Also when you're laying down pads you'll probably find the occasional place where the layout shows a track going between two pads and there isn't enough space. Not to worry; this can be fixed later.

Once all the pads are down you're ready to start connecting them up. The golden rule here is to try and make the tracks and the spaces between them of equal width. When you finally use the artwork to make a printed circuit you'll discover that tracks less than about 0.020" tend to be etched right through and similarly spaces between tracks less than 0.020" tend to not separate so these are the absolute minimum spacings to be used. To make things easier until you're familiar with the process I strongly recommend that you use minimum dimensions of 0.040" both for tracks and spaces. These rules (like any) can be bent if you know what you're doing but if not it saves rework to stick to them.

To connect between pads first trim the end of the tape square. Hold the end of the tape over the first pad and press it down firmly. Run the tape carefully in the path you want to follow until it reaches the second pad. Press it down firmly onto the second pad. Cut it off by pressing the blade of your knife onto the tape not hard enough to cut it then pull the tape up to cut it off. If you try and cut the tape while it's stuck on the pad you'll cut both tape and pad.

When you're laying down tape you must try not to put it down under tension. If the tape is stretched as it's stuck down it tends to creep back after it's cut off and open up spaces. This particularly applies to taping around corners.

It's inevitable that the layout will in-

clude some curved tracks. When you tape them the tape must have no tension; better to be slightly in compression.

To do this you must, as you're laying down the tape, continually push it back on itself slightly with the tip of the knife blade. It's something of a knack to do it correctly.

After every piece of tape is placed and cut off press it down hard. Pounding on it with a closed fist is quite acceptable — you can't press it down too hard.

During all this you *must* keep all grease or oil away from the artwork. Contact adhesives simply will not stick to oil and all your work will fall off if the film is dirty.

If you find that you must run tape between two pads that are too close and you can't maintain clearance then as a last resort it's permissible to carefully cut away a bit of the pad. There must be at least 0.030" of pad left around the centre hole or when you drill the hole in the board you'll break through the side of the pad. Then you won't get a good solder joint. This method should always be thought of as an act of desperation — not a standard technique.

When you're taping up the artwork it helps a lot to always refer back to the original diagram to keep track of what you're doing. You'll probably find a mistake or two.

Once the taping is completed and checked, all that remains to be done is to mark the mounting holes with large diameter pads. Mark the corners of the board so you know where to trim after the board's been etched. You can put tape all around the edge of the board if you want but it's more usual only to mark the corners. The tape for the corner marks goes

outside the actual edge of the board so when the board's trimmed the corner marks are cut off. When you think it's really finished check it again. This is the last chance you'll get to have an error free layout.

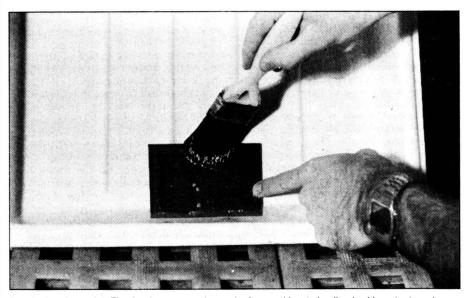
Etching

The next step is to ensure that the artwork is the correct polarity for the photoetching process you intend to use. If you are using dry resist precoated board material then you must obtain a reversal, or negative, of the taped artwork you've generated. If the original artwork was twice full size this comes naturally, as the photography gives a negative.

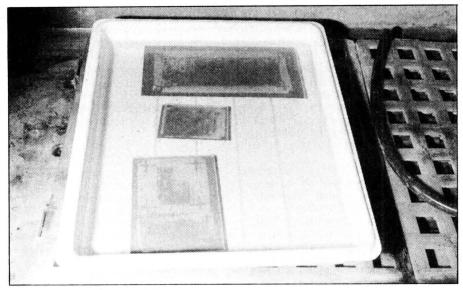
If you worked 'one to one' then you must get some "Scotchcal" exposure film. This stuff is like photographic film except that it's only sensitive to ultraviolet light and you only need one chemical to develop it.

To expose the film place the sensitive surface under the UV source and lay the mask over it. Make sure the mask is the right way up so the pattern that will finally appear is not mirror imaged. Place a sheet of good, heavy glass over the mask. I use a piece 6 mm thick which is enough to press the mask flat against the UV sensitive surface. For the suntan lamp UV source it's necessary to cover the whole assembly with something opaque (say a book) for about sixty seconds until the lamp warms up. After that the mask and sensitive material can be uncovered to commence the actual exposure.

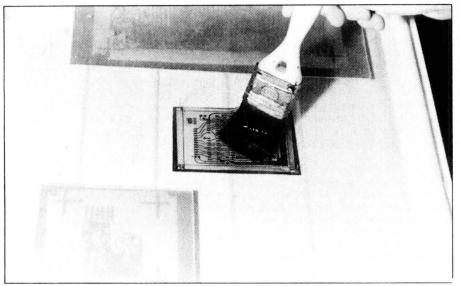
If you've bought precoated board all you have to do to prepare the surface for exposure is to unwrap it in dimly lit artificial light. If you want to do the whole



Developing the resist. The developer comes in powder form and has to be dissolved in water to make up a solution. Treat this solution with care as it is poisonous.



The etching process. Place packing under the tray to tilt it at a slight angle and three-quarters cover the bottom with etchant. Drop the board into the high end of the tray, copperside up.



Turn the board over and use a fine (25 mm) brush to get fine detail.

thing yourself then you'll have to buy some photoresist and it's appropriate developer. Circuit Components in Bexley, NSW, sell all the necessary materials for all stages of making printed boards and are quite happy to give advice if you're not certain what you need.

The correct resist to directly expose taped up artwork is CPR Positive Resist. The developer for this resist comes as a powder that has to be dissolved in water to make up a solution. Have a thought for the neighbourhood kids though and don't keep the developer in a soft drink bottle. It's a poison and doesn't do rug-rats any good at all to drink.

To coat the board with resist, first clean the copper thoroughly with an abrasive cleanser such as "Gumption" using clean paper towels. Grease or fingerprints on the copper is a disaster for the coating process so don't touch the surface at all. After scrubbing the copper dry it with paper towels (cloth towels may have traces of grease). Then tip a small pool of the photoresist onto the centre of the board and work it all over the surface by tipping the board this way and that.

You may also use a small paint brush to work the resist into the corners of the board but make sure it's a good one that doesn't shed hairs. Use plenty of resist to make sure the board is completely covered then stand the board on edge on a thick wad of newspaper. All the excess resist will drain off to leave a nice even film.

Next stoke up the kitchen oven (this isn't called "kitchen sink technology" for nothing) and set the thermostat for 175°F or 80°C and allow it to warm up. Place the board in the oven — resist side up on a piece of paper towel or newspaper and cook it for 15 minutes. This serves to drive off all the solvent in the resist and leave a hard dry film.

If you leave it in too long the resist

Exposing the film

The photo etching process used with circuit boards works with ultraviolet light. This has the advantage that it does not require a darkroom. All the equipment can be handled in normal ambient light, with the proviso that you need to avoid any strong sources of UV. Since this includes the sun, it's probably a good idea to work at night if at all possible. If not, then make sure you are well away from windows, etc.

For the actual exposure, you can use either a sunlamp or a purpose built UV light. The recommended UV source for both Scotchcal and photoresist is a Philips UV mercury discharge tube. This will fit into a 20 W fluoro batten.

A quite effective exposure box can be made by nailing together a box with one side open. The internal surfaces should be painted white, and the lamp mounted in its batten opposite the opening. The opening should be filled with a sheet of glass. The distance from the top of the glass to the tube should be about 50 mm.

For exposure the box should be positioned with the glass side up, the artwork placed on the glass and held down with another piece of glass.

Note that when UV tubes have been unused for a while, or are being operated in very cold ambient temperatures, they take a while to reach their normal operating output. Leave them burning for at least fifteen minutes before you start work with them.

If you don't want to go to all that trouble, a simple, but less accurate way to do things is to use an ordinary old sunlamp. Position this about 350 mm above the artwork. But be careful. If you expose your hands to the rays for too long you'll get sunburnt.

won't develop properly; too short and the developer takes off the lot so time it carefully. This process is called the prebake and is vital to good resist processing.

But note that some resists have special requirements you should be aware of. Circuit-components insist that "gas ovens, fan-forced electric ovens and sealed electric ovens are not suitable. Beware of stove ovens with grease deposits." They also warn against direct exposure to infrared from the elements of an electric oven.

After the 15 minutes are up take the board out. Lay the artwork over the board and cover the lot with a piece of glass as described. If you use the suntan lamp as a UV source the CPR film needs between 3 minutes 30 seconds and 4 minutes for correct exposure with the lamp 350 mm from the resist.

For the 20 W UV tube advice on exposure is given with the resist. After exposure lay the board face up in a glass dish and cover it with developer. *Don't* use aluminium or iron dishes as the developer will attack them as well.

Gently agitate the dish by rocking it. The resist will dissolve away where it's been exposed to light.

For the precoated boards you will have exposed it through a Scotchcal reversing film mask and the resist will dissolve where the mask protected it.

The developing process should only take a few minutes and when it's complete

there should be absolutely no trace of resist where it should be dissolved. Even the minutest trace of resist will prevent proper etching and ruin the board so carefully examine the board to make sure the coloured resist has been completely dissolved.

To stabilize the resist film after development turn the oven up to 200°F or 95°C and postbake the board for 20 minutes. This bake isn't quite as critical as the prebake (once I forgot and left it in for 3 hours with no ill effects!). Finally take the board out and let it cool and stabilize for about half an hour and it's ready to etch.

The easiest etchant to use is ferric chloride and you can buy bottles of ready made solution. Be warned though, this stuff is the most foul staining corrosive gunk imaginable and the tiniest drop will leave a totally unremovable yellow mark on clothes or anything else.

Good housekeeping is essential. It will also etch stainless steel just fine (like kitchen sinks!!!) so don't spill it. If a few drops are spilt on a stainless steel sink and it's rinsed down the faint traces left will corrode the sink in a few hours and leave rust marks that are hard to get off. It's best to use the etchant in a tray placed on

several thicknesses of newspaper.

As well as the etchant and tray you'll need a very cheap 25 mm paint brush with the bristles trimmed off about 10 mm. Place some packing under one end of the tray so it's tilted at a slight angle and tip enough etchant into the tray to three-quarters cover the bottom. Drop the board into the high end of the tray, copperside up, and brush the etchant over the copper.

You'll see a black powdery deposit form on the bare copper then dissolve and wash away. Keep on brushing, concentrating on the areas that have no tracks and have large bare areas to be etched. For some reason the etching process seems to favour areas that have lots of tracks. In five to ten minutes, depending on solution age and temperature, all the areas not covered by resist will completely dissolve.

It's possible to use ammonium persulphate instead of ferric chloride if you like. This is not as easy to use, but it doesn't stain and it's not as corrosive.

The process is essentially the same. However you need to heat it to 50°-60°C. It won't work at room temperature. Also, it can't be stored. It slowly releases gas and decomposes. If you attempt to seal it

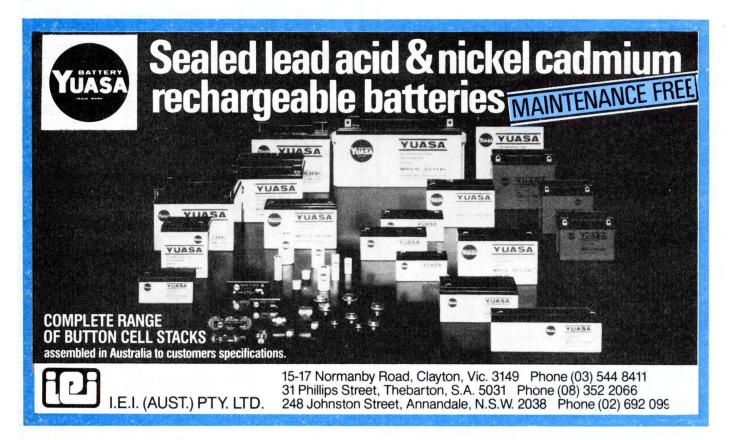
in a bottle, the bottle will explode.

As soon as all the copper is etched away remove the board from the tray and rinse it using megalitres of water. Examine the board carefully to make sure that all the copper is really dissolved then put the solution back in its bottle to be used again.

Rinse out the tray and brush once again using vast quantities of water and make sure you haven't spilled a drop of etchant anywhere. If you have you'll find out soon enough from the tirade of abuse from wife and/or mother.

Finally, remove the resist with solvent acetone and a paper towel. It comes off easily unless you forgot and postbaked it for hours. Trim the board to size with a hacksaw and clean up the edges with a file so you just remove the corner marks. Then drill all the holes with a small hand drill. The drill size should be about 0.8 mm for most components but some need a larger size, say 1.2 mm.

At this stage you should have a nice neat printed circuit board of your own design ready to assemble and try. For the first time the process seems long and messy but after a few tries you'll find it easy, quick and most satisfying.



3 KIKUSUI

WE'RE NOT RIDING ON A REPUTATION.

WE'RE MAKING ONE!

COS 5041 40MHZ WITH DUAL TIME BASE







KIKUSUI COS 5041

- LOW COST
- 2 Channel 40MHz bandwidth
- 1mV/Div 20nS MAX sweep speed Built-in DELAY-LINE • Trigger LEVEL
- LOCK Variable HOLD-OFF
- Other quality KIKUSUI oscilloscopes - COS-5020 20 MHz (on NSW Govt. contract)
- COS-5042 40 MHz 3CH, delay.
- COS-5060A 60 MHz 3CH, delay.
- COS-5100 100 MHz 3CH, delay.
 DSS-5020 20 MHz + Digital Storage.

The most economical 40MHz CRO that has more than just a trigger delay BUT a full DUAL TIME BASE that allows ANY portion of a displayed wave-form to be MAGNIFIED.

★ ALWAYS INCLUDED:

2 PROBES 10:1/1:1 2 TERMINAL **ADAPTORS**

GFG-8016D

W INSTRUMENTS PROVEN RELIABLE

GW FUNCTION GENERATORS **GFG-Series** 88888



 Variable: DUTYCYCLE DC OFF SET

1 Year Warranty

3 Models Available:

GFG-8015F function generator. GFG-8016S sweep generator. GFG-8016 D with built in

frequency counter

GW BENCH-TOP DC SUPPLIES ECONOMICAL & ROBUST · Variable voltage and short circuit current Overload/short circuit PROTECTED · Auto constant voltage, constant current cross-over Over 20 MODELS in SINGLE and DUAL tracking • FULL 1-YEAR WARRANTY

Some of our popular models include:

GPS-1830 1 x 18V.3A GPS-1820H 1 x 18V,20A GPS-3020 1 x 30V,2A GPS-3010H 1 x 30V.10A

GPC-3020 2 x 30V,2A and

ALSO AVAILABLE FROM VIC Radio Parts Group, Melbourne NSW Davred Electronics Sydney Phone 267 1385 Geoff Wood Electronics Pty Ltd. Rozelle Phone 810 6845

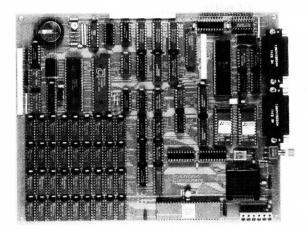
Phone 329-7888
WA Hinco Engineering Pty Ltd. Perth
Phone 381 4477 Prione 381 44// Int'l Communication Systems Pty Ltd Port Adelaide Phone 47 3688 George Harvey Electronics, Hobart Phone 34 2233

EMONA INSTRUMENTS A division of Emona Enterprises Ptv. Ltd.

1st Floor 720 George St Sydney, 2000. Phone: (02) 212-4599



-186 80186 SINGLE BOARD COMPUTER



Prices **Features** 995.00 8MHz 80186-3 (10MHz optional) Kit A&T 1250.00 Up to 1Mbyte parity checked memory Two serial ports to 38400 baud Mini Kit 250.00 Centronics printer interface Double density 8" or 51/4" floppy disc interface **TurboDOS** 395.00 25.00 SASI hard disc interface Manual Boot ROMs CMOS battery backed calendar clock All + 20% Sales Tax TurboDOS operating system available

POSITRONIC COMPUTERS

1 STRATHAIRD CLOSE, DIAMOND CREEK, VIC. 3089 (03) 438 2713

RAM/EPROM SALE

4164-12 Ram 27128 Eprom \$12 plus Tax 2764

Emtronics Sydney City 2110531
Martin De Launay (Newcastle) Pty Ltd. Phone 52 8066
Electronic Components Pty Ltd. Fyshwick
Phone 80 4654

OLD Batec Systems Pty Ltd. Busbane Phone 369 5900 Nortek Townsville Phone 79 8600

\$3 plus Tax Eprom \$7 plus Tax

SWITCHMODE POWER SUPPLIES

HITRON \$85.00 incl. +12, -12, -5, +5 @ 8A

VEP \$45.00 incl. +12, -5, +5V @ 8A

BRAND NEW 20 inch X Y **MONITORS \$100**

100's of USED 2732 EPROMS

& VIDEO GAME PCB'S GOING CHEAP

SYD (02)5691733, 22-24 Cook Road, Marrickville MELB (03)4192466,

13 Hood Street, Collingwood

DESIGNED AND MANUFACTURED IN AUSTRALIA

AT LAST!

A BUDGET PRICED 19 INCH RACK SYSTEM

ZIP-RACK 19A is the basic rack system for your 19 inch rack mounting equipment, kits & PCB sub-racks.

ATTRACTIVE ANODISED ALUMINIUM FINISH

STANDARD FRONT FACE MOUNTING FORMAT

FAST EASY KIT ASSEMBLY

THREE STANDARD RACK SIZES



Advance Australia

ZIP-RACK 19 IS DESIGNED AND MANUFACTURED IN AUSTRALIA

|--|--|

SIZE	KIT No.
6 RU	19-111
12 RU	19-112
18 RU	19-113

1 Rack Unit (RU) Panel is 44.5 mm high (13/4 in.) ALL RACKS ARE 358 mm DEEP.

KIT CONTENTS

- ★ 12 Frame Sections
- ★ 4 Top Corners
- ★ 4 Lower Corners
- ★ 12 Clip-in M6 Nuts*
- ★ 12 M6 Screws*
- ★ 1 Pack of 'Pop' Rivets
- ★ 1P&N Drill
- ★ Simple, easy to follow instructions

ASSEMBLY

Tools required: Small rubber mallet; electric hand drill; hand rivet tool. Twelve lengths of hollow extrusion are interlocked using eight plastic corner pieces. The plastic corners are inserted into the hollow sections using a small rubber mallet. This assembly is then made permanent by drilling and pop riveting each corner with drill (3.2 dia.) & pop rivets supplied with kit. No spanners, screws, nuts or washers. Just a clean fast fit.

BY

AUTOTRON AUSTRALIA

PO Box 202, Glen Waverley, 3150, Victoria, Australia. Telex 38433 Telephone (03) 763 6423 NSW: CONTACT YOUR LOCAL JAYCAR STORE FOR THEIR CUSTOMISED ZIP-RACK 19J

VIC: ACTIVE ELECTRONICS: MELBOURNE (03) 602-3282 SPRINGVALE (03) 547-1046

W.A.: ATKINS CARLYLE: (09) 321-0101

LOCAL & OVERSEAS DISTRIBUTORS ENQUIRIES WELCOME

^{*} For equipment mounting

25 WATT UHF POWER AMPLIFIER s. K

S. K. Hui

The powers that be are often just not quite enough when it comes to radio transceivers. "Are you receiving me?" Loud and clear with the help of this ETI project to boost your transmitting signal to a very audible 25 watts.

HOW DO YOU feel about your transceiver radio not being able to deliver the full legal output power? Have you ever wanted to stretch your transceiver power to its legal limit? I guess you might think the idea is great but sounds a little too complicated. Having to modify your expensive transceiver radio is always difficult — and risky! What if you can't put everything back to where it was, after pulling your transceiver

apart? Of course if it blows up, you can always buy a new one with higher output power.

For those of you who are radio communications enthusiasts, the following could be great news for you. Without changing anything in the transceiver, you can boost the output power to 25 watts! All you need is the ETI 743 — UHF amplifier to simply plug the antenna and your transceiver output into. And the cost in building this project is minimal when compared to buying another transceiver set.

Credit for the design is due to Gary Crapp and Gill MacPherson from Dick Smith Electronics. The project is available in a kit form, with parts from Dick Smith Electronics and others.

Amplifier circuit principle

The idea of the ETI-743 UHF amplifier is quite simple. As soon as you start transmitting, the amplifier senses the signal and boosts it up to 25 watts! In the absence of a transmitting signal (receiving mode), the amplifying circuit is bypassed, thus allowing the transceiver to directly see the received signal from the antenna.

The ETI-743 amplifier should be used for amateur radio transmissions. Although technically it could be used in UHF CB band operation in that same frequency range, you must check the conditions of your licence to make sure that it does not exceed the power level stipulated.

The amplifier can be divided roughly into three parts: attenuator, amplifying circuit and signal level detection circuit (see Figure 1). The signal level detection circuit senses the strength of the transceiver output signal. Depending on how strong the signal is the circuit will turn the LED and the relays (RLY1, RLY2) on or off. As soon as the ETI-743 circuit is turned on, a signal path is set up, linking the antenna directly to the output of your transceiver. This allows you to listen to the air as usual.

Pushing the "talk" button on your transceiver radio will activate the signal level detection circuit. As a result both relays and

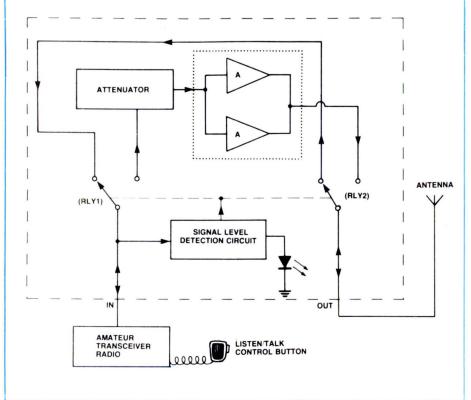


Figure 1. The three basic parts of the amplifier: attenuator, amplifying circuit and signal level detection circuit.



the transmitting LED will be turned on to indicate that amplification is activated. The output signal from the transceiver will be connected to the attenuator by RLY1. The output of the attenuator feeds IC1 and IC2, the hybrids, and output of these hybrids is fed to the antenna by RLY2.

These Motorola MHW710-2 hybrid rf amplifiers (IC1 and IC2) are connected in parallel using four matching transmission lines. These minimize the reflection of signal due to impedance mismatching. Each amplifier by itself can deliver a maximum of 12.5 watts. Two combined will give an exciting 25 watts output. These amplifiers are capable of operating over a frequency range from 440 MHz to 470 MHz.

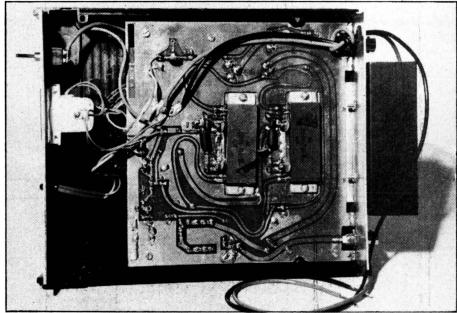
At first sight, the attenuator network looks rather redundant, however it is important. It attenuates the transmitting signal to a power level that won't saturate the hybrid amplifiers. A 300 mW signal is required by the two rf hybrid amplifiers (each takes 150 mW), to obtain maximum output power.

Most amateur transceiver radios are 5 W output. If yours isn't you must carefully choose the right attenuation to suit your particular transceiver. The selected resistance values shown in the Parts List for R1 to R7 are suitable for 4 to 5 W transceiver radios only. If you happen to be one of the unlucky few who have a 1 or 2 W output transceiver radio, some fiddling of the resistance values is unavoidable (see "attenuator" box).

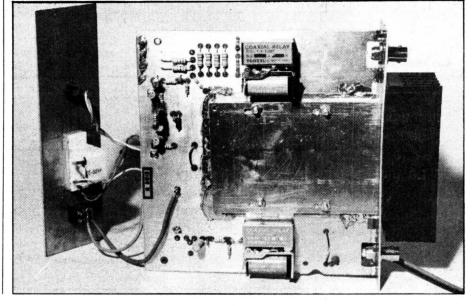
Construction

The construction work involved in this project is more mechanical than electrical. Instead of the usual method of assembling the board first and somehow mounting it later, you will have to sort out mounting problems first.

You must first make the cut-outs on the main pc board as shown on the pc board artwork. Cut the front and rear panels from a single sided pc board. Rectangular holes and slots have to be cut out in the front and







rear panel as well as the main board. This can be done by first drilling a hole somewhere inside the area you want to cut out, inserting a saw blade through the hole and cutting out the area.

Next drill and cut all the holes on the main board and the panels. In order to reduce the ground plane impedance, the grounded tracks on both sides of the board have to be joined together electrically by means of copper foil. Three pieces of foil need to be soldered in the positions shown in Figure 2. The 28G copper foil is cut to about 23 mm wide, 12 mm long, soldered on the ground track, bent round the edge of

the board and soldered onto the other side of the board. Now get a bigger piece of copper foil (about 108 x 81 mm) of 24G and solder it onto side B of the pc board as shown in Figure 2, to cover the rectangular holes. I know how anxious you are to solder the components on board but wait a little longer, you will find it worth the time.

The next thing you have to do is to mount the main pc board into the case. If you have the right plastic case, there will be four plastic mounting studs standing out on the floor. Put four 12 mm spacers on the mounting studs. Land the main pc board with side A facing up gently on the spacers without

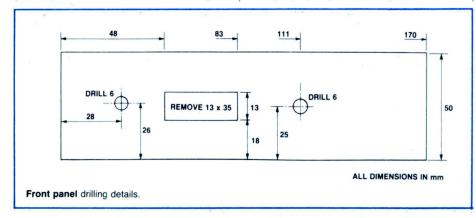
knocking them down. If the mounting holes on the pc board were drilled correctly, they should align with the spacers. Fasten the board with 20 mm long, ½" screws and insert the rear panel. The kinky edge of the main board should now touch the rear panel to form a right angle. With the copper side of the rear panel facing the kinky edge, the main board is soldered onto the rear panel to make this right angle structure rigid and sitting comfortably in the case.

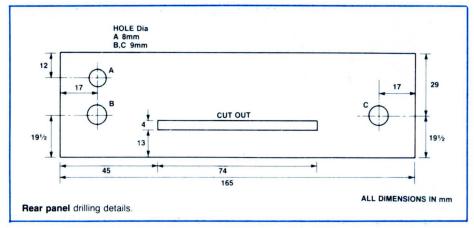
The trickiest part is the mounting of the heatsink and the two hybrid amplifiers. An aluminium angle about the size shown in Figure 3a is inserted into the slot on the rear panel. It goes all the way in until the shorter arm of the aluminium angle is pressing against the rear panel. The longer arm of the aluminium should be forced to press tightly against the large copper foil you just soldered on the main board. You should put something between the longer arm of the aluminium and the floor of the case to provide the support for the aluminium while you drill it.

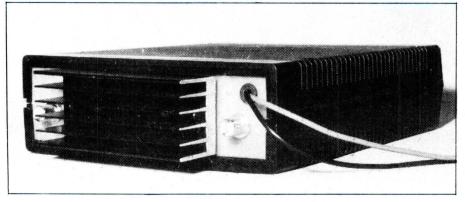
Now put the two hybrid amplifiers into the rectangular holes on the main board, and align the pins of the amplifiers with their corresponding tracks on side A of the board. Carefully mark out the mounting holes for the amplifiers on the copper foil using a sharp needle. Remove the hybrids and drill the four holes on the copper foil according to your marking. The holes should go right through the aluminium as well. You should mount the hybrid amplifiers onto the copper foil using a heat transfer compound on the bottom sides of the amplifiers. Screw the amplifiers down firmly and solder their pins onto the pc board.

Take a heatsink with dimensions as shown in Figure 3b. Drill two holes in it (for 1/8" screws) about 50 mm apart between two vanes, at about half its height. The heatsink is then placed against the shorter arm of the aluminium angle. On the surface of the shorter aluminium arm mark two corresponding holes and drill them right through to the rear panel. Evenly spread the heat transfer (silicon) compound on the aluminium surface. This sandwich structure (heatsink-aluminium-rear panel) is then fixed by using two 1/4" screws. Holes B and C as shown in rear panel drilling details are for mounting two BNC connectors on the rear panel. When you do so make sure their pins are lying flat on the corresponding tracks on the main board; they are soldered directly onto the tracks. Make sure the connectors are firmly tightened.

The rear panel, heatsink, main board and the aluminium should now form one single rigid structure. Remove this structure from the case and you can start putting components on the main board. You will find some of them are sitting on side A of the







HOW IT WORKS — ETI-743

The rf signal at the BNC input (see Figure 2) is sensed by capacitor C1, and rectified by diodes D1 and D2 before driving the base of transistor Q1. In the receiving mode, the signal from the antenna is not strong enough to turn on Q1. Under this condition, the LED is off, relays are not energized and the amplifying circuit is idle.

As soon as you start transmitting, the much stronger signal from your transceiver radio output will turn on Q1, thus short circuiting capacitor C3, and forcing R14 and R10 to form a potential divider generating roughly 5.3 V to the base of transistor Q2. This voltage is enough to saturate Q2 (that is, turn it on). The emitter junction of the turned-on Q2 starts to conduct like a forward blased diode and this diode, in shunt with the D3 and R14, effectively brings the 5.3 V back to about 11.3 V. The base current is then limited by R10 to around 11.3 mA.

Both relays RLY1, RLY2 and the LED are connected in parallel. The saturated Q2 will give rise to about 12 V across all three turning them on. Current through the LED is limited to about 12 mA by R11; current through the relays is limited by their resistances. Diode D4 and capacitor C8 are there to protect the transistor Q2 from the damaging inductive effect of the relays' coils during switching.

The amplifying circuit consists of two hybrid amplifiers (IC1 and IC2) each of which has a gain of 19.2 dB. A 150 mW signal injected into one will give an output power of $0.15 \times 10^{1.92} = 12.5$ watts. Two in parallel gives 25 watts but requires a 300 mW input signal.

Connecting both amplifiers together is not an easy job at all. Impedance matching has to be allowed for or signal reflection may occur. Most transceivers have an output impedance of 50 ohms. The input impedance of each hybrid amplifier is also 50 ohms. Connecting two hybrids in parallel obviously won't give 50 ohms anymore. The idea is to connect each amplifier input with a transmission line before they join together. The characteristic impedance of both transmission lines is 75 ohms and they are a quarter wavelength long.

The impedance looking into each amplifier with a quarter wavelength long transmission line connected becomes 112 ohms. Since there are two in parallel, the input impedance looking into the whole amplifying circuit becomes 112/2 = 56 ohms, which is pretty well matched to your 50 ohm radio. A similar arrangement connects the amplifiers' outputs together to match your 50 ohm antenna. These four transmission lines are printed as normal copper tracks on a pc board with their lengths carefully calculated.

As you may have noticed from the circuit diagram or the mask of the layout, diode D5 connects to the ground through a short piece of copper track. It acts like a little antenna picking up the rf signal from the circuit, rectified by D5. The output drives the M1 meter. Hence the meter provides the indication of the strength of the rf signal.

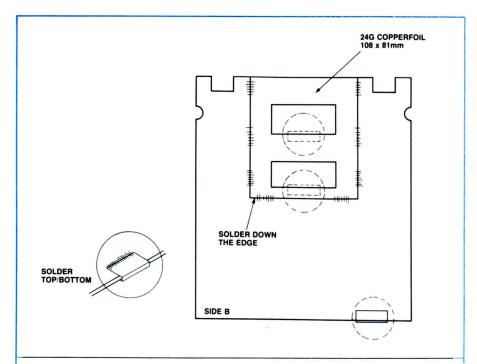


Figure 2. Copper foil soldering positions. Three pieces of foil should be soldered into position. The larger square piece of foil is soldered on to cover two of the small pieces.

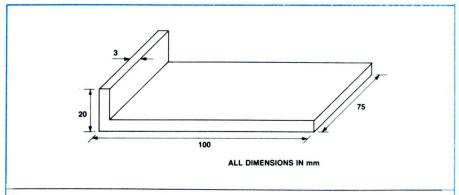


Figure 3a. Dimensions of aluminium angle.

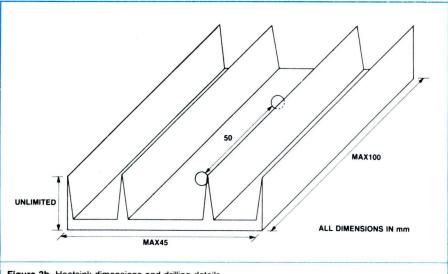


Figure 3b. Heatsink dimensions and drilling details.

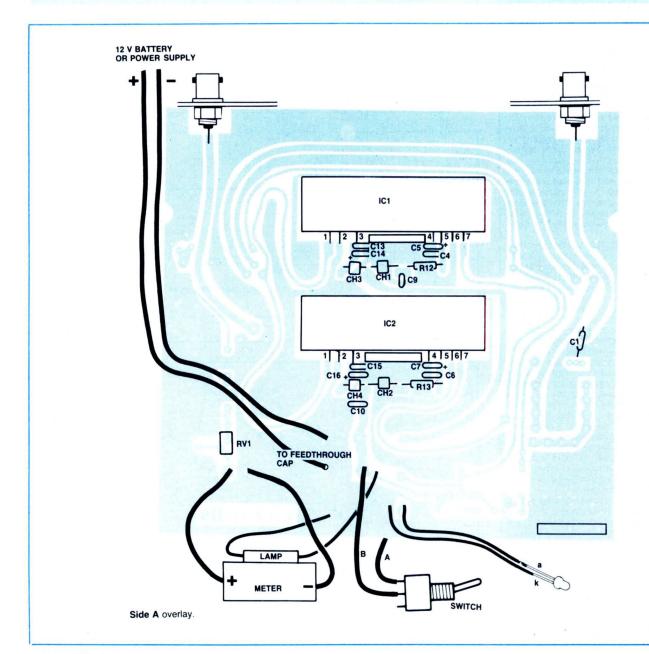
PARTS LIST — ETI-743

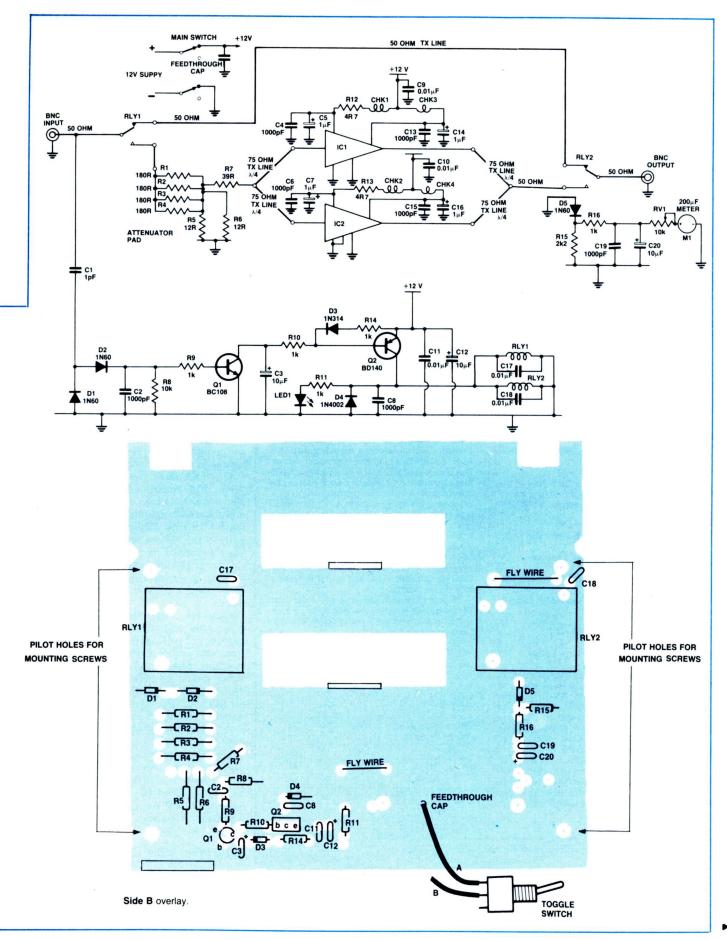
Resistors	all 5%
R1, 2, 3, 4	180R (1 W)
R5, 6	12R (1 W)
R7	39R (1/4 W)
R8	10k (1/4 W)
R9, 10, 11,	
14, 16	1k (1/4 W)
R15	
R12, 13	4R7 (1/4 W)
VR1	10k trimpot
Capacitors	
Ċ1	1p ceramic
C2, 4, 6, 8, 13,	
15, 19	1000p ceramic
	10µ (16 V) tant. or
C5, 7, 14, 16	
Contract of a primary of the state of	the state of the s

elect.

C9, 10, 11, 17,	
18	0.01µ ceramic
C20	10µ (16 V) elect.
	1000p feedthrough
	ceramic
Diodes	
D1, 2, 5	1N60 high freq.
D3	1N914 small sig.
	1N4002 rectifying
	red LED 5 mm
Semiconductors	
Q1	BC107 or BC548
Q2	BD140
IC1, 2	MHW 710-2
rf choke accesso	
CHK1, 2	6-hole ferrite bead

CHK3, 4	single hole ferrite bead
Miscellaneous	
SW1	DPDT toggle switch
BNC1, 2	BNC connectors
M1	200 µA meter
RLY1, 2	coaxial relays
copper foil (23 spacers; 100 mr	er foil (108 x 81 mm); one 28G x 36 mm); LED holder; four m heatsink for IC1, IC2; a right section; one plastic case (210 x
	ont and rear panels; one double
	500 mm red/black wire, a short
length of 25BNS	insulated wire for making the r
	and screws (1/8") for mounting
the hybrid ampli	fiers.
Price e	stimate: from \$129





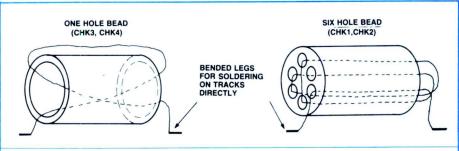


Figure 4. Winding diagram of the two ferrite beads.

ATTENUATOR

An input signal injected into a T-shape attenuator shown in Figure 5 will suffer a loss of power. The ratio of output signal power to input signal power defines the degree of attenuation. Normally, people take the log of this ratio and multiply it by ten to give the attenuation in terms of dBs. In our case, the attenuation of such a T-shape resistor network is given by:

Attenuation (dB) =
$$log [A/B]...(1)$$

where
$$A = 56 \times Rc$$

 $B = Ra \times (Rc + Rb + 56) + Rc \times (Rb + 56)$.

Recalling that 300 mW in the output of the attenuator is required for the hybrid amplifiers, the attenuation you need for an 'M' watt transceiver is:

Attenuation (dB) =
$$10 \times \log (0.3/M) \dots (2)$$

For instance, if M = 1 W, using equation (2):

Attenuation = 10 x log
$$(0.3/1) = -5.23 \text{ dB}$$

This must be equal to the expression in equation (1) so we have:

$$-5.23dB = 20 \times log [A/B]$$

where A and B are defined previously.

The values for A and B are dependent upon the values of Ra, Rb, Rc. It is only a matter of choosing the values for Ra, Rb, Rc to make both sides of the above equation as equal as possible. For this 'M = 1' watt case, I have chosen Ra = 15 ohms, Rb = 18 ohms and Rc = 82 ohms to give $-5.25\,\mathrm{dB}$, which is approximately equal to $-5.23\,\mathrm{dB}$.

To make life easier for you, a set of resistance values are given for different transceiver output powers. These figures are tabulated below for quick reference. You may have realized from the actual pc board art-

work that there are four sets of resistor holes for Ra and three for Rb. This means you can build up Ra and Rb with more than one resistor in parallel using:

$$\left(\frac{1}{R_{com}} = \frac{1}{R_1} + \frac{1}{R_2} + \dots \right)$$

Because of the power requirement, parallel resistors Ra and Rb must be at least 1 W rating. If you prefer to have a single resistor for Ra and Rb, it has to be at least 4 W rating — for a 5 W transceiver.

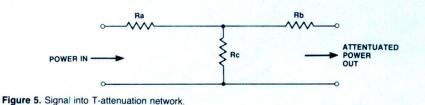
After all these calculations, you probably think this is the end of the story. Unfortunately, it is not! We found the theoretical values don't work in practice. The numbers you have just calculated or borrowed from the table assumed pure resistance. The ones we use in practice are slightly inductive. A factor of 2 was recorded between the calculated attenuation value and the value obtained from the working resistor values. The quickest method of determining the attenuation is to hook up a wattmeter to the output BNC connector of the unit. Take the values from the table (or calculate them) and solder the resistors on the board.

Turn on the unit and note the indication of the power level on the wattmeter. If it is not 25 watts, you will have to fiddle with the resistor values until it is.

Warning: Never use variable resistors for Ra, Rb or Rc, because all variable resistors are inductive.

TABLE 1

Transceiver output power in watts	Ra	Rb	Rc
1	15	18	82
2	110	22	47
3	27	27	33
7	33	33	22



board and some are on side B. The side B ones are soldered in a normal way, that is, insert their pins through the holes on the pc board and solder them on the other side. Pins of the side A components should be bent and soldered onto the tracks which are on the same side as the components. Make sure the pins of the components are cut as short as possible to avoid picking up unnecessary rf signal.

The winding diagram of the two ferrite beads is shown in Figure 4. Hole A on the rear panel (see rear panel drilling details) is for the red/black cables to bring 12 volts supply in for the unit. For safety and reliability reasons, you should tie the cables together to make a knot near that hole.

Just one last thing in case you've forgotten, check the polarity of the meter M1 and all the capacitors (except the ceramics) before soldering them on.

Testing and setting up

Hook your antenna and transceiver up to the unit. Be very very careful, because the two BNC connectors on the rear panel look exactly the same. If you are looking at the rear panel with the heatsink facing you, the left BNC connector should go to your transceiver output. The right BNC connector should go to the antenna.

If you are lucky your transceiver output power will be around 5 watts. All you then have to do is to apply 12 volts to the unit and turn it on using the toggle switch on the front panel. Please, do check the polarity of the battery before you connect it. Once connected, the lamp for illuminating the meter should come on. If not, check that the wires connecting the lamp to the board have a 12 volt difference between them.

Press the "talk" button in your transceiver radio and several things should happen: the red LED on the front panel should come on with a clicking sound from the switching relays, and the pointer in the meter should be deflected. Take a screw driver to adjust the RV1 trimpot until you get full scale deflection. This should correspond to around 25 watts output power.

A better way to calibrate the meter in the front panel is to use a power meter. Dick Smith Electronics has a UHF wattmeter which connects to the unit. With the "talk" button pressed, read the output of the wattmeter and adjust the RV1 trimpot at the same time until the meter gives full scale deflection.

Artwork: pc board layout is available on request to ETI, P.O. Box 227, Waterloo, NSW 2017.



Business people will welcome it as a new price break-through in near letter-quality printers. Hackers will welcome it as a whole new standard in low-cost printers.

On appearances, you'd never suspect it was a low-cost printer.

And when you see its superb, near letter-quality printing, you'll find it hard to believe that the recommended retail price (excluding sales tax) is around \$410!

The Epson "NLQ Special" gives you so much more than you've learned to expect from a printer in this price range.

It offers superb, near letter-quality printing in a variety of type styles and sizes.

It has a variety of word processing functions built in so you can produce professional-looking documents even without word processing software.

It prints up to 100 characters per second, and includes a 1024 byte input buffer which reduces the amount of time your computer is tied up during printing.

It produces charts and graphics with a crispness and definition that's seldom been seen on a printer in this price range. It comes with standard friction feed, optional tractor and cut sheet feeders, and uses standard interfaces.

There is so much more to the Epson

LX-80 that you won't find on other low-cost

printers. Call in to your nearest Epson dealer and see
what's so special about the "NLQ Special."

The "NLQ SPECIAL" by EPSON



Success breeds success

It seems that every IC company in the world offers a semi-custom service.

So why choose Plessey?
Well, as a major supplier of
semi-custom ICs, we can offer a track
record of success and experience few
others can match. In every area of
application, including telecoms,
robotics, business computers and
data processing, we've consistently
achieved a high first-time success
rate. In fact, the chances of you not
getting it right first time with Plessey
are exceptionally low.

How do we do it?

In a word, accessibility. We offer a range of options that gives you maximum access to our semi-custom programs from day one.

A simple low-cost terminal is all you need to key into one of our software suites: proven interactive simulation programs for you to run in your own time, on your own premises. And of course you can call in on our Design Rooms any time you need help or product testing.

But, if you prefer to use our facilities, we have Design Rooms in

At a glance Plessey semi-custom

- Choice of cell-based or gate array techniques.
- High first-time success rate.
- Comprehensive low-cost software support for interactive simulation.
- Full bureau service.
- Total manufacturing capability.
- More performance from a given chip.



England, Germany, California and now in Sydney.

This includes access to the best test unit in the business, the Teradyne J941. (At a cost of nearly \$1 million it should be.)

Our semi-custom routine means that we'll supply you with an end result that's testable, workable and manufacturable, in just a few working weeks.

With all the options to choose from we'll never force you into a

non-optimum solution.

So, whichever semicustom option you choose, whether cell-based or gate array, the end product will be every bit as advanced as the design techniques.

If you feel the semicustom service you're using now is only giving you half the story, send for the Plessey Semi-Custom Portfolio.

If you're ready for success so young, that is.

Plessey Semiconductors Pty Ltd. 122 Arthur St, North Sydney NSW 2060. For information call: Joy Thorne (02) 72 0133. Telex 20384.



In a word, success

MICROBEE JOYSTICK ADAPTOR

This simple project neatly connects a standard joystick to the Microbee's parallel port. You don't have to butcher the joystick cable, it will plug into the adaptor which in turn plugs into the Microbee. And it meets the 'Official Standard For Joysticks On The Microbee' according to Applied Technology.

Geoff Nicholls

THE PROJECT IMPLEMENTS the circuit described in the *Microbee Engineering Notebook*, which was reprinted in the *Microbee Hackers' Handbook* on pages 55 and 56. NOTE: There is a mistake in the Connection Table on page 55. The DB9 Table has LEFT and RIGHT interchanged; the correct connections are:

JOYSTICK PINOUT	FUNCTION
1	UP
2	DOWN
3	LEFT
4	RIGHT
5	not used
6	FIRE
7	not used
8	COMMON
9	not used

The Table showing the DB15 connections is also wrong; LEFT should go to pin 12 and RIGHT should go to pin 4.

Construction

Check the printed circuit board for shorts, especially where the tracks pass between the pads of the DB-15P.

Solder the link in first, then the seven resistors. Next, insert the right angle plugs and push them right down flat against the pc board before carefully soldering the pins.

The board comes without pre-drilled mounting holes for the plugs to allow all types to be used, so you will have to run a drill through the pc board. I used 6BA screws to secure the plugs.

NOTE — If you want to do the project on the cheap you can solder the joystick wires straight to the pc board and save the cost of the DB-9P connector.

Programming for the joystick

Two test programs are reproduced to test the joystick. The shorter one was written by Applied Technology and prints out "up", "left", "fire" etc as appropriate.

I wrote the other program to do simple screen drawing.

There are a few points to watch when writing software to use the joystick. You should include the line "OUT 1,255" in the initialization section of your programs to make sure the PIO is set up for input.

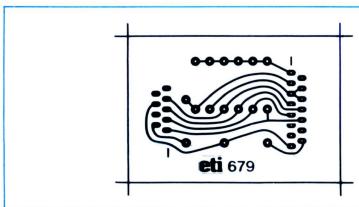
The switches produce a '0' when close and a '1' when open, so the numbers obtained directly from the port may seem a little strange at first. Lines 120 to 190 of the short program show one technique for identifying which switch (or switches) are closed.

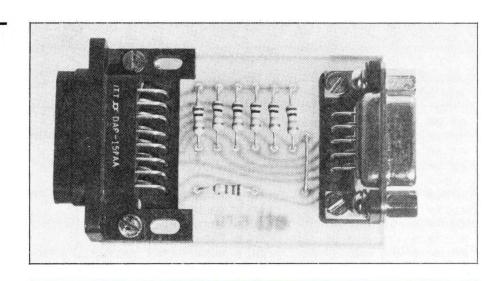
If you simply input directly from the port (that is A=IN(0)) then you will get the following numbers; note the centre number is for the stick in the central position.

250	254	246	122	126	118
251	255	247	123	127	119
249	253	245	121	125	117
(fire	buttor	off)	(fire	button	on)

Converting games for joystick control

It is possible to change programs that use the keyboard for game control over to the joystick. The general idea is to list the program and look for the lines that include keywords like "INPUT", "KEY" or "KEY\$" and modify the program to use an "IN(0)" instead. Consider the changes made to the following lines of a games program:





HOW IT WORKS — ETI-679

There is really nothing to it!

The joystick itself consists of four switches arranged so that moving the stick closes one or two of the normally open switches. The switches are arranged like the points of the compass, so that moving the stick in the north-east direction will close both the north and the east switches. A fifth switch is used for the fire button, some joysticks have two parallel fire buttons.

The adaptor provides pull up resistors for the data lines to the port to guarantee a binary '1' when the switches are open. The unused data lines (D4, D5 and D6) are pulled high by R5.

The ASTROBE input to the Microbee's Z-80 PIO is tied low by R7 to allow input operations without handshaking.

PARTS LIST — ETI-679

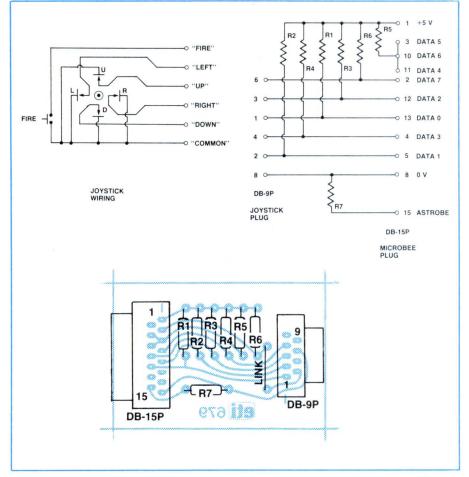
Resistors R1-R6.....

R1-R6......10k R7......1k2

Miscellaneous

ETI-679 pc board; 1 x DB-9P and 1 x DB-15P connectors; 2 x right angle plugs; screws.

Price estimate: \$7



 $\emptyset\emptyset\emptyset7\emptyset$ F=A:CURS(E+M):PRINTCHR(129);CHR(13 \emptyset);:I=ASC(KEY):IF I=44 THEN LET F=B

ØØØ8Ø IF I=46THEN LET F=P

Unmodified keyboard control.

ØØØ7Ø F=A:CURS(E+M):PRINTCHR(129);CHR(13Ø);

ØØØ75 I=IN(Ø)

ØØØ76 IF I=251 THEN LET F=B

ØØØ8Ø IF I=247 THEN LET F=P

Modified for joystick control.

The first two lines use the two arrow keys "<" and ">" to move the object around. I removed the "I=ASC(KEY)" statement and replaced it with "I=IN(0)" on a new line. All that was left to do was to change the numbers that the "I" variable is compared to, to suit the joystick. In the example the "<" key (44) is for left motion and corresponds to 251 on the joystick port. The ">" key is replaced by 247. There were no other places in the program where the motion keys were used, so the joystick conversion was complete!

TEST PROGRAMMES

```
00100 REM joystick test program for Microbee
ØØ11Ø OUT 1,255
                        :REM initialise port
ØØ12Ø A=IN(Ø)
                        :REM read joystick port
ØØ13Ø A=143-(A AND 143) :REM convert to positive
logic
                        : IF B THEN PRINT "up",
ØØ14Ø B=-(A AND 1)
                        : IF B THEN PRINT "down",
ØØ15Ø B=-(A AND 2)
                        :IF B THEN PRINT "left",
ØØ16Ø B=-(A AND 4)
                        :IF B THEN PRINT "right",
ØØ17Ø B=-(A AND 8)
                        :IF B THEN PRINT "fire",
ØØ18Ø B=-(A AND 128)
ØØ19Ø IF A=Ø THEN PRINT "nothing", A ELSE PRINT A
ØØ2ØØ FOR T=1 TO 1ØØ : NEXT T :REM short delay
ØØ21Ø GOTC 12Ø
```

```
ETI-679 Joystick Adaptor
ØØØ1Ø REM
ØØØ2Ø REM
            Screen drawing program.
ØØØ3Ø REM
ØØØ4Ø REM
           Variables;
            A.....joystick port value
00045 REM
ØØØ5Ø REM
            Z,X.....X co-ordinates
ØØØ6Ø REM
            T,Y.....Y co-ordinates
ØØØ7Ø REM
            F.....Fire Button (logical)
ØØØ8Ø REM
            F=-1 if Fire pressed
            F=Ø if not pressed
ØØØ9Ø REM
ØØ1ØØ CLS :LORES
ØØ11Ø OUT 1,79 :REM set up pio for input
ØØ12Ø Z=63 : T=24 : F=Ø
ØØ13Ø GOTO 23Ø
ØØ135 REM
ØØ136 REM Update variables
ØØ14Ø A=255-IN(Ø)
ØØ145 REM Check Fire Button
ØØ16Ø IF A>127 THEN LET A=A-128:F=-1
ØØ17Ø IF A=Ø THEN 14Ø
ØØ18Ø IF A>7 THEN LET Z=X+1 : A=A-8
ØØ19Ø IF A>3 THEN LET Z=X-1 : A=A-4
ØØ2ØØ IF A>1 THEN LET T=Y-1 : A=A-2
ØØ21Ø IF A>Ø THEN LET T=Y+1
ØØ215 REM Erase last point if Fire Button pressed.
ØØ22Ø IF NOT F THEN RESET X,Y
ØØ225 REM Set new graphics point.
00226 REM First wrap around to stay within screen
ØØ23Ø X=Z: Y=T
ØØ24Ø IF X>127 THEN LET X=Ø
ØØ25Ø IF X<Ø THEN LET X=127
ØØ26Ø IF Y>47 THEN LET Y=Ø
ØØ27Ø IF Y<Ø THEN LET Y=47
ØØ28Ø SET X,Y
ØØ29Ø F=Ø
ØØ3ØØ GOTO 14Ø
```



OUALITY SEMICONDUCTOR PRODUCTS 68000-6500

	exempt
R68000C6	CPU Ceramic DIL \$55.7
R68000Q6	CPU Plastic Compact QUIP \$36.7
	8, 10 MHz available
	12 MHz available soon
R6502P	CPU, 40 pin
R6503P	CPU, 28 pin
R6504P	CPU, 28 pin
R6507P	CPU, 28 pin
R6511Q	Single chip microcomputer, 64 pin CPU, RAM ACIA I/O,
	Timers, 64K Address \$20.9
R6520P	PIA 40 pin
R6522P	VIA 40 pin, 20 I/O, 2 x Timer/Ctr S. Reg \$7.3
R6532P	COMBO 40 pin, 128 byte RAM, 20 I/O, Timer \$9.2
R65410	Slave Processor, 64 x 8 RAM, 23 I/O, host slave I/F, timers,
	4 K, external address \$15.0
R6545-1P	Video controller \$12.5
R6551P	ACIA integral Baud rate gener. \$8.8
R6592P	Single chip printer controller for Epson Low cost
	printer
CMOS	
R65C02P1	CPU, 50 pin plastic, enhanced instruction set \$10.0
R65C21P1	PIA 40 pin
R65C24P1	PIAT, I/O x Timer 40 pin 6821/6521 compatible \$9.4

ACIA 28 pin

MODEM CHIP SETS ...

R65C51P1

PKIN	I FR2	
CPA-80	Centronics and Serial versions expandable to 8K buffer	available, 100 cps, 2K
	Centronics	Ex Tax \$281.68 Incl Tax \$321.23
	Serial	Ex Tax \$304.30 Incl Tax \$346.19
DWX-305	Letter quality daisywheel printe	ır,
	18 cps	Ex Tax \$519.75 Incl Tax \$595.16

\$10.00

\$495.43

Cut Sheet Feeder Ex Tax \$332.73 Incl Tax \$372.66 Ex Tax \$111.12 Incl Tax \$123.78 SHINKO 300 cps, Dot Matrix, near Letter quality Ex Tax \$1035.51 Incl Tax \$1188.17

TATUNG TVT600A TERMINAL Ex Tax \$803.22

DISC DRIVES

	F-051APC	5.25" slimline SSDD 40 track, Taut band, direct	
1		low noise	Ex Tax \$228.13
	CF82AP2	Slimline disc drive	Ex Tax \$187.31

HIGH PERFORMANCE DEVELOPMENT **TOOLS FOR 6502 FAMILY**

EC-EI EC-M EC-PI EC-LI EC-64 MPF-	EPROM Programmer	Ex Tax \$77.44	
EC-T	TLT Tester	Ex Tax \$138.00	
EC-M	EMT Memory Tester With Fast Programmer	Ex Tax \$256.00	
EC-P	ALP PAL Programmer Incl Software	Ex Tax \$426.52	
EC-LO	OG Logic Analyser 10 MHz		
EC-64	Apple (TM) compatible, variety of packages a	Apple (TM) compatible, variety of packages available	
MPF-	PC IBM (TM) compatible, variety of packages av	IBM (TM) compatible, variety of packages available	

A variety of instrumentation tools available for laboratory instrumentation CONTACT THE OFFICE FOR PRICES AND AVAILABILITY

> *All prices subject to sales tax if applicable Please allow \$5.00 Post and Package with all orders

SUBSTANTIAL QEM QUALITY DISCOUNTS AVAILABLE PLEASE CONTACT THE OFFICE FOR PARTICULARS



73 Eric Street, Goodna, Qld. Aust. P.O. Box 6502, Goodna, Qld. 4300 Telephone (07) 288-2455. Telex AA 43778 ENECON

* ALL PRICES ARE SUBJECT TO CHANGE WITHOUT NOTIFICATION *
BANKCARD AND MASTERCARD ACCEPTED

Errors and Onlisions Excepted.
ICLT106 ICLT116 ICLT116 ICLT116 ICLT117 ICLT616 ICLT117 ICLT618 ICLT61
19.50 6.989 6.999
74H106 2.5. 74H108 2.5. 74H108 3.5. 74H108 3.5. 74H108 3.5. 74H108 3.5. 74H108 3.5. 74C00 5. 74C00 5. 74C00 5. 74C00 5. 74C00 5. 74C00 5. 74C00 6.
10
MM58174 19.50 MM59303 7.50 MM59309 14.50 MM59301 19.50 LM0911 1
SC152D 6.90 CT03Y 9.90 CT03Y 9.90 CT03B1 9.90 CT03B2 1.20 AC1221 1.20 AC1227 1.20 AC1227 1.20 AC1227 1.20 AC1227 1.20 AC1228 1.20 AC1289 1.50 BC1389 1.50 BC1389 1.50 BC1389 1.50 BC1389 1.50 BC139 1.50
MRF455 37.00 MRF475 77.00 MRF475 77.00 MRF475 77.00 MRF475 77.00 MRF661 19.00 MRF6
WH8BAF 3.95 S2SC372 1.95 S2SC3
741488 2.00 74150 1.20 74151 1.20 74151 1.20 74152 1.20 74153 1.20 74155 1.00 74160 1.00 74160 1.00 74161 1.00 74161 1.00 74161 1.00 74161 1.00 74161 1.00 74161 1.00 74161 1.00 74161 1.00 74161 1.00 74161 1.00 74161 1.00 74161 1.00 74161 1.00 74177 1.00 74177 1.00 74177 1.00 74177 1.00 74177 1.00 74177 1.00 74177 1.00 74178 1.00 74179 1.00 74191 1.00 74191 1.00 74191 1.00 74192 1.00 74193 1.00 74194 1.00 74195 1.00 74196 1.20 74197 1.00 74198 1.00 74191 1.00 74191 1.00 74192 1.00 74193 1.00 74194 1.00 74195 1.00 74196 1.20 74197 1.00 74198 1.00 74191 1.00 74191 1.00 74191 1.00 74192 1.00 74193 1.00 74194 1.00 74195 1.00 74196 1.20 74197 1.00 74198 1.00 74191 1.00 74191 1.00 74191 1.00 74191 1.00 74191 1.00 74192 1.00 74193 1.00 74194 1.00 74195 1.00 74196 1.20 74197 1.00 74198 1.00 74191 1.00 74191 1.00 74191 1.00 74191 1.00 74191 1.00 74192 1.00 74193 1.00 74193 1.00 74194 1.00 74195 1.00 74196 1.00 74197 1.00 74197 1.00 74198 1.00 74191 1.00
FD1771 19.00 FD1791 (8876) FD1793 (8877) FD1793 (8877) FD1793 (8977) FD1793 (8977) FD1793 (8977) FD1797 39.00
PSI 1.20 PSI
425 High NORTHOC VICTORI Phone (0 TELEX: A 8-50 A' MELBOL VICTORI Ph. (03) Mail Ord correspo P.O. BO' NORTHOC MAIL (103) 48 POSTAGE \$1.59.99 \$100.199 \$200.5499 \$25.549.9 \$25.549.9 \$250.599.9 \$100.199 \$200.5499 \$200.5
C'S 1-9 24.95 29.50 20.512.50 20.59.00 29.95 20.50 20.
IA It, IA IO IO IO IO IO IO IO IO IO

BOOKS OF SPECIAL INTEREST

electronics textbooks

ELECTRONICS: IT'S EASY - VOL 1

\$5.95

Meters, resistance, capacitance and inductance, emitter followers, op-amps, power supplies, elec-

ELECTRONICS: IT'S EASY — VOL 2

A0002E

Digital sub-systems, counters and shift registers, A-D and D-A conversion, digital instruments and test equipment, computers, transmission links, oscilloscopes.

ELEMENTS OF ELECTRONICS — BOOK 1

\$9.95 A0003B

This five-book series is an introduction to modern electronics. All the maths is taught as the reader progresses. The course concentrates on the understanding of concepts central to electronics, rather than digressing over the whole field. The author anticipates where difficulties lie and guides the reader. Book 1 covers all fundamental theory necessary to full understanding of simple electronic circuits and components.

ELEMENTS OF ELECTRONICS — BOOK 2 A0004B

\$9.95 Alternating current theory — see Book 1.

ELEMENTS OF ELECTRONICS — BOOK 3

Semiconductors technology leading to transistors and ICs — see Book 1.

BASIC ELECTRICITY/ELECTRONICS - VOL 1

Thorough theoretical and practical background to the overall subject of electricity and electronics.

BASIC ELECTRICITY/ELECTRONICS - VOL 2 \$15.95

Builds on the basic information in Volume 1 by giving detailed information on AC and DC circuits covering series and parallel circuits, electro-magnetism, resistance, capacitors and inductance plus associated calculations.

BASIC ELECTRICITY/ELECTRONICS — VOL 4 A0011H \$15.95

Construction, operation and usage of electronic test instruments. Included are analogue and digital vacuum-tube voltmeters, multimeters, scopes, tube testers, bridge instruments and signal generators

REFERENCE DATA FOR RADIO ENGINEERS

Largest and most comprehensive collection of equations, graphs, tables, and other reference data needed in radio engineering and deisgn.

amateur radio

LONG-DISTANCE TELEVISION RECEPTION (TV-DX)

N0250B \$6.95

Written by the British authority, the book includes many units and devices made by active enthusiasts. A practical and authoritative introduction to this unusual aspect of electronics.

HANDBOOK OF RADIO, TELEVISION, INDUSTRIAL AND TRANSMITTING TUBE AND **VALVE EQUIVALENTS**

N0251B The equivalents books for amateurs and service-

men. More than 18,000 old and new valves from United States, Britain, Europe, Japan. CV (military) listings with commercial equivalents included.

AN INTRODUCTION TO RADIO DXING N0253B

\$6.75

One section is devoted to amateur brand reception and the other section covers broadcast band reception, with advice on suitable equipment and the techniques employed when using that equipment. The construction of a number of useful accessories

25 SIMPLE AMATEUR BAND AERIALS

How to build 25 amateur-band aerials that are simple and inexpensive to construct and perform well. From the simple dipole up to a mini-rhombic

HOW TO BUILD ADVANCED SHORTWAVE RECEIVERS

N0340B \$6.95

Contains full practical construction details of a number of receivers.

THE WORLD IN MY EARS N0420C

This book would represent the 'basic manual' for anyone interested, or active in, shortwave listening. Written by world-renowned authority and broad-caster, Arthur Cushen, M.B.E., the book is divided into two parts. The first covers the historical development of shortwave broadcasting and the listen-ing hobby that grew up with it. The second part covers the practical aspects: how to start out, how to erect antennas, all about time and time zones, DX clubs, reporting, news sessions, etc.

electronic music and audio/video

CHEAP VIDEO COOKBOOK G0123P

\$12.90

Complete discussion of a new, low-cost way to get words, pictures and opcode out of your computer and onto any ordinary television screen, using a seven-IC easy-to-build circuit which you can build

ELECTRONIC MUSIC CIRCUITS

G0126P

How to build a custom electronic music synthesiser, outlines numerous other circuit designs and then shows you how to modify them to achieve particular responses. Many of the circuits can be used as special-effects boxes for guitars and other musical instruments.

INTRODUCTION TO ELECTRO-**ACOUSTIC MUSIC**

G0127N

\$24.95

This book assumes no previous technical knowledge. It discusses the relationship between the technology and the composition of electro-acoustic music.

SOUND-SYSTEM ENGINEERING

G0129P

\$35.50

Dealing with audio systems as a whole, it includes installing and equalising the sound system and interfacing the electrical and acoustic systems, instrumentation, the acoustic environment and designing for acoustic gain.

TUBE SUBSTITUTION HANDBOOK G0130P

\$8.75

Complete, accurate, up-to-date guide to direct substitutes for receiving and picture tubes. Contains more than 6000 receiving tube substitutes, 4000 monochrome and colour picture tube substitutes, and 600 communications substitutes. Also includes pinouts for quick operational checks.

HOW TO BUILD SPEAKER ENCLOSURES

\$9.95 G0131P A guide to the 'whys' and 'hows' of constructing top-performance loudspeaker enclosures.

SON OF CHEAP VIDEO

G0345P

Don Lancaster's sequel to The Cheap Video Cookbook (ETI Book Sales No. G0123P) includes new and improved circuits to get alphanumeric and graphics video out of a microcomputer and on to an ordinary television.

SINGLE-CAMERA VIDEO PRODUCTION

G0379H

\$25.75

Step-by-step diagrams and illustrations show you how to produce low-budget, high-quality video programs. Chapters on audio, lighting, shooting, editing, graphics and set design

All prices of publications in this catalogue listing are subject to change without notice.

More BOOKS of Special Interest on page 82

ORDER TODAY — Simply return the Freepost reply card to:

TO OUR READERS ...

\$25.00

best sellers

STARTING FORTH

A clear and complete guide to Forth, this book covers fundamental principles and then a full set of high-level Forth commands. It concludes with advanced techniques and style.

WALL CHART — RADIO, ELECTRONICS, SEMI-CONDUCTORS AND LOGIC SYMBOLS B0020B \$2.95

Identify those symbols at a glance. A must for beginners and advanced enthusiasts alike. Professionals can always hide it in their desks!

COIL DESIGN AND CONSTRUCTION MANUAL

B0413BHow to make RF, IF, audio and power coils, chokes and transformers. Covers AM and FM radio, and TV. An essential addition to the library of all interested in electronics.

INTERNATIONAL DIODE EQUIVALENTS GUIDE 803398 \$6.9

Includes zener diodes, LEDs, diacs, triacs, thyristors, OCls, photo diodes, display diodes and simple rectifier diodes.

ELECTRONICS SECURITY DEVICES D0059B

Besides incuding both simple and more sophisticated burglar alarm circuits using light, infra-red and ultra-sonics, this book also gives circuits for gas and smoke detectors, flood alarms, fire alarms, doornhones, etc.

50 PROJECTS USING RELAYS, SCRs AND TRIACS E0068B

Practical working circuits using silicon controlled rectifiers, relays and bi-directional triodes. With a minimum of difficulty you can use them in motor control, dimming and heating control, timing and light sensitive circuits, warning devices and many others.

G0135B ELECTRONIC MUSIC PROJECTS

\$5.95
Provides constructors with practical circuits for the less complex music equipment including fuzz box, waa-waa pedal, sustain unit, reverb and phaser, tremolo generator, etc. Text covers guitar effects, general effects, sound generators, accessories.

HOW TO BUILD YOUR OWN SOLID-STATE OSCILLOSCOPE F0282B

This book comprises a project divided into sections for builder to individually construct and test — then assemble into complete instrument. Includes short section on scope usage.

MODERN RECORDING TECHNIQUES G0128P \$22.95

Explains the equipment controls and techniques found in a modern recording studio and how to use them creatively and correctly to produce a desired result. Numerous photographs, diagrams and charts

THE 68000: PRINCIPLES AND PROGRAMMING K0176P \$19.95

An easy-to-read, systematic approach to the 68000 advanced 16-bit microprocessor. The book guides you through the complex architecture, instruction set, pinouts and interfacing techniques. Written for design engineers, programmers and students.

ELECTRONIC TROUBLESHOOTING HANDBOOK

This workbench guide shows you how to pinpoint transistor troubles in minutes, how to test almost everything electronic and how to get the most out of low-cost test equipment.

\$13.95

EFFECTIVELY USING THE OSCILLOSCOPE

F0257H

F0258P \$16.95
Describes the potential uses of the scope, ranging from audio and television tests and measurements to performance tests.

ELECTRONIC SYNTHESISER PROJECTS G0133B \$5.95

For the electronic music enthusiast, an invaluable reference. This book is full of circuits and information on how to build analogue delay lines, sequencers, VCOs, envelope shapers, etc, etc. The author takes a clear and logical approach to the subject that should enable the average enthusiast to understand and build up what appears to be a quite complex instrument.

HOW TO GET YOUR ELECTRONIC PROJECTS WORKING

Helps you to overcome the problems of a circuit that doesn't work by indicating how and where to start looking for many of the common faults that can occur when building up a project.

WORKING IN THE MUSIC BUSINESS GO279A

GO279A \$11.95
Gives realistic insights into the work and lifestyles found in the music business, and would be of interest to anyone considering work in recording studios, record companies, music publishing, etc.

THE MUSICIAN AND THE MICRO GO280A

A straightforward and practical guide for musicians, teachers and those who work in the music industry, covering the exciting world of microprocessors and computerised musical instruments.

PRACTICAL ELECTRONIC CALCULATIONS AND FORMULAE B0027B

Fcr the practical person's workbench. Bridges the gap between technical theory and cut-and-dried methods which work but leave the experimenter unfulfilled. There's a strong practical bias. High maths avoided where possible.

HANDBOOK OF ICS EQUIVALENTS AND SUBSTITUTES

B0281B \$6.95 Contains full interchangeability data on more than 9500 ICs with possible alternatives and equivalents shown. Covers many types of digital and linear ICs. Recently reprinted.

Electronics Today est

magazine holders/binders

now available

MAGAZINE BINDERS

\$7.50

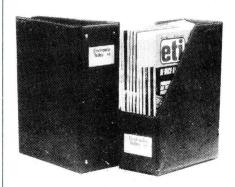
Ready to use binders with easy, clip-in fastener, covered in soft, decorator brown vinyl. Holds 12 issues of Electronics Today.

MAGAZINE HOLDERS

\$7.00

Big, easy to assemble holders, covered in soft, decorator brown vinyl Holds 12 issues (at least) of Electronics Today.

Postage and packing additional: Please refer to reply card for charges.



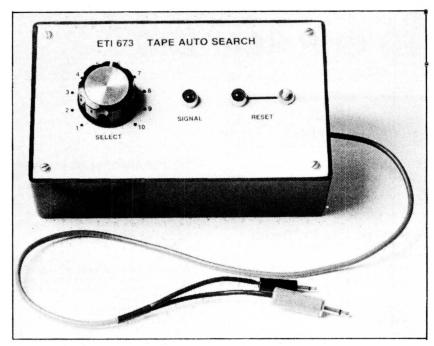
- SAVE WITH SIX -

6 Holders — only \$37.50 6 Binders — only \$39.95

FEDERAL MARKETING BOOK SALES

PO Box 227, Waterloo 2017, NSW

TAPE AUTO-SEARCH



THE CASSETTE is probably the most cost effective means of information storage in use today. Capable of storing whole symphonies, dozens of computer programs, or anything that can be converted to an electrical signal, the cassette is surely the most widely used form of data storage.

However, the major difficulty with the cassette is accessing information on it. It usually seems to happen that the section you want is somewhere at the end, and it can often take longer to find the selection than to play it out.

Many tape recorders come equipped with search facilities, which will fast forward to the desired track, stop, and then enter the play mode. Marvellous, if you have one, even better if you can commandeer it for your exclusive use to help find the computer program you know is somewhere about half-way along the cassette.

The ETI-693 is a simple add-on device that can be plugged into a suitable portable cassette player, and which can then be used to find any one of 10 selections in a very short time. It uses a player that can cue in search mode, like the National RQ-2133, or other players with modifications.

The principle of operation is to count the gaps between each track, and to then stop when the right number of gaps have been passed. This means that the play head must be in contact with the tape when the tape player is in its fast forward (or even rewind) modes. One difficulty, of course, occurs when the information on the cassette is analogue such as music or speech, and when quiet sections (or pauses in speech) occur. The search system registers these pauses as a gap, and you end up in confusion. However, with judicious selection of components and time periods between each selection on the cassette, even this problem can be overcome. In general, the unit will work best with digital data, but I have used it for both purposes with great success.

The 'hardware'

Before discussing the auto-search unit, it is better to first attend to the requirements of the cassette player. Depending on the brand of player some modifications, either electrical or mechanical, may be required. I have successfully integrated the unit with two totally different types of players, and have checked various others for their suitability.

The main mechanical requirement is that, when the player is in its fast forward mode, the play head be in light contact with the cassette tape. As it happens, some cassette players have this facility already, actuated by pressing both the PLAY and FAST FORWARD (sometimes called the CUE) keys. The idea is to listen to the sound as it passes rapidly past the play head, and to mentally count the gaps.

Many National brand cassette players have this feature, in particular the National Model RQ-2133. This particular unit is ideal for the auto-search, as only very minor electrical modifications are required to adapt it for use. These modifications are described later in this article, so if you own one of these tape players, or intend buying one, then you can proceed happily to building the electronics.

If you decide to try to adapt another type of tape recorder, like the one the kids used to use until they took over the hi-fi, first determine if it can be suitably modified. Many Sony tape recorders cannot be modified, but other types, particularly those with a single rotary switch arrangement can be. It is impossible to describe a general technique, due to the differing arrangements employed. I can only give general requirements, the best will be up to your mechanical ability.

In general, the tape head should advance towards the tape, when in fast forward mode, slightly less than it does when in the play mode. If it is too far forward it will slow the tape transport system, and if not enough, it will not allow a signal to be generated by the head. An easy method of determining if the head position is correct is to listen to the result through the player's speaker.

The correct position is when the loudest sound occurs, without the transport slowing down. Naturally, the erase head, often just a permanent magnet, should not be allowed near the tape, as you'll lose everything. Often, just bending a lug here and there is sufficient, so don't be surprised if the modifications turn out to be easier than you thought.

Electrical modifications

In order to make the auto-search unit as simple as possible, I decided to make the tape recorder supply the power to the unit. The power requirements are very low, around 10 to 20 mA, because of CMOS and diode logic. This means, however, that the circuit has to be able to cope with either polarity of earth associated with the tape player.

The pc board layout accommodates both types of polarity, with very minor differences occurring between the two. The circuit can operate with differing voltages, with 6 V being the most typical voltage available from the player. The National RQ-2133 uses a negative earth at 6 V but if you are adapting another player, determine the polarity first.

In order that the auto-search can integrate with the player, use is made of the phono sockets generally present somewhere on the side of the player. The sockets used are the so called MONITOR (or earphone) socket, and the REMOTE socket. The REMOTE socket is generally next to the MIC socket. The principle of the auto-search is to replace this switch with a transistor that is in turn operated on by the electronics within the auto-search.

This project requires some electrical modifications to the tape recorder. If you don't feel confident about these we advise you not to try this one.

Now you can load several programs on a single cassette and find a particular one quickly and easily. The ETI-693 auto-search will also find a track on an audio cassette.

Peter Phillips

As already mentioned, it may also be necessary to modify the tape recorder electronically. Because the auto-search not only derives its power from the tape recorder, but also controls the power to the tape recorder, the electrical relationship between the player's power supply, remote socket, and the player's electronics and motor must be as shown in Figure 1b. The differences between Figure 1a and 1b are that in 1a, the remote socket is wired between the motor/electronics and earth, while in 1b, the remote socket has been moved between the supply rail and the motor/electronics. Figure 1 shows how to modify the National RQ-2133 tape recorder.

The procedure for the RQ-2133 is farily simple. Firstly, remove the five screws holding the back cover, including the one in the battery housing. Remove the single red screw holding the tone/volume control assembly, and lift this assembly clear. Remove the three screws holding the pc board in place to gain access to the track side. Cut the tracks as shown in Figure 1b, and connect the two links. Finally, relocate the wire that originally connected S2 to the point shown in Figure 1b. This completes the modifications, and allows the player to work normally, as well as allowing it to now interface with the auto-search.

Other tape players may already be electrically correct, but this point needs to be determined, and, if necessary, corrected.

Electronic modifications

With the tape player now ready, construction of the auto-search electronics can proceed. Start by mounting all the passive components, then mount the transistors and ICs. Note the wire link to the left of IC1. Also note that all diodes, except D1, are placed the same way, with the cathode towards the bottom of the pc board.

All the ICs are also orientated the same way, with pin 1 facing the top of the pc

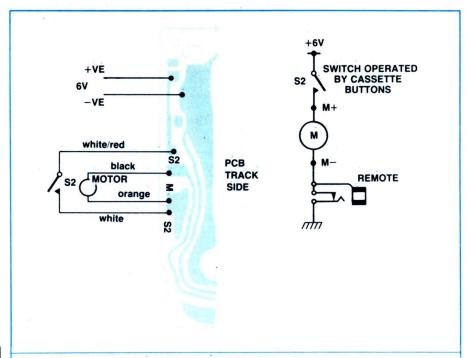


Figure 1a. Circuit diagram of the National RQ-2133 before alterations.

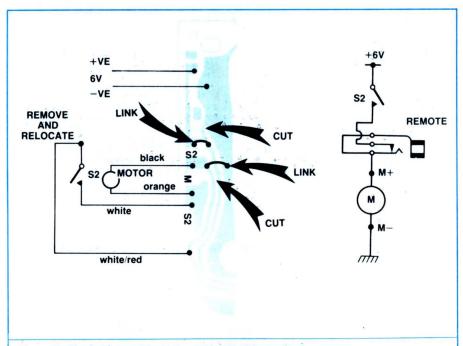


Figure 1b. Circuit diagram of the National RQ-2133 after alterations.

board. When you come to mount transistors Q4 and Q5, follow the layout for the particular polarity of tape recorder. The overlay diagram shows the layout for a negative earth system, such as the RQ-2133 with the necessary modifications for positive earth separately detailed. The differences are the orientation of Q4, the type of transistor for Q5, (NPN for positive earth) and the position of the two links in between these two transistors.

With the pc board completed, connect

the LEDs, and switches SW1 and PB1, allowing about 140 mm lead length. When wiring SW1, note that pin 1 of the switch is not connected. The layout shows the view for SW1 with the connecting terminals facing towards you. The use of rainbow cable is recommended, to facilitate correct connection of SW1 to the pc board.

Normally, a 2.5 mm phono plug is required for the remote socket, and a 3 mm plug for the monitor socket. In the prototype, I squeezed four wires into an 800 mm

HOW IT WORKS

To consider the operation of the circuit, assume selection 6 on a cassette is required. SW1 is set to position 6 and RESET (PB1) has been pressed. Operation of the RESET pushbutton will cause IC3, a dual decade counter, to be set to 0, which in turn causes Q2 to be turned off, allowing Q3 to be turned on and lighting LED 2.

The position of SW1 (at 6) will cause diodes D6 and D7 to be forward biased, presenting a logic 0 at the inputs of inverters IC1a and IC1c. SW1, diodes D4 to D14 and inverters IC1a to IC1d together form a decimal to binary converter, using diode logic. Inverter IC1a is the LSB, and IC1d the MSB, and the range of output numbers from the inverters is from 0 to 9.

Thus, position 1 causes an output of 0000, and position 10 an output of 1001. At position 6, the output will be binary 5. The outputs of the counter, and the decimal to binary converter are fed, in bit parallel fashion, to the EXOR gates, IC4a to IC4d.

An EXOR gate will have a logic 1 at its output if its inputs differ, so in the case under discussion, gates IC4a and IC4c have differing inputs, and hence produce a logic 1 at their outputs. This will cause Q4 to be turned on, via diodes D15 and D17, which will drive Q5 on. If the tape recorder is now set into motion, current to the tape recorder will flow through Q5, and the search will commence.

Signal from the tape recorder is applied to the half-wave voltage doubler comprising C1, C2, D1 and D2. RV1 is a sensitivity control, and D3 isolates C3 from C2. If the signal level is sufficient from the tape recorder, the dc voltage produced across C2 will forward bias Q1, causing its collector voltage to drop.

Inverters IC1e and IC1f are connected as a Schmitt trigger, and the output of IC1e will now become a logic 1. This allows IC2, a '555 timer connected as a monostable, to time out,

and then to set its output (pin 3) low, lighting LED 1 (SIGNAL).

The '555 timer is present to allow small bursts of signal that may be present during a gap to go unnoticed, and to thus prevent false counting. The delay of the timer must be sufficiently short however, to allow intended short sections of data (such as a small program) to be recognized when tape speed is maximum, towards the end of the tape. Altering either R7 or C4 to a lower value may be necessary under these circumstances.

When a gap on the cassette appears, Q1 will turn off when C3 has discharged. C3 allows small gaps in the signal to be ignored, such as may occur in analogue information. Thus, the output of IC1e goes low, setting the output of the '555 high. The signal LED goes out, and the counter will increment one count, extinguishing the reset LED. Thus, the first block of data on the cassette has been passed, and the sequence continues until five blocks of data have passed. When the gap before the selected block is reached, that is, after the fifth block of data, the counter will increment to binary 5. As this equals the output of the decimal to binary converter, all the EXOR gates have equal inputs, and all these gates (IC4a) to (IC4d) produce a logic 0 at their outputs. As there is no drive for Q4, both Q4 and Q5 are turned off, and the tape recorder stops, cued ready at the desired selec-

As mentioned in the article, the circuit can be adapted for use with either polarity of tape recorder. Because CMOS logic has been used, typical cassette voltages of 6 V and 9 V can be used. It may be necessary to alter the value of R17, to allow adequate saturation of Q5. In the prototype a value of 330 ohms was found suitable, for either polarity, with a tape recorder voltage of 6 V.

PARTS LIST — ETI-693

Resistors	all 1/4 W, 5%
R1	470R
R2, 14	10k
R3	100k
R4	2k2
R5	22k
R6	
R7	82k
R8. 13	
R9, 10, 11, 12	
R15. 16	
R17	
	25k trimpot (large vertical)
	go volucui,
Capacitors	all 16 V tantalum
~ .	

Semiconductors

Semiliconductors	
D1, 2	0A90
D3-D22	1N914
LED1	5 mm red
LED2	5 mm green
Q1, 2, 3, 4	BC548 or equiv.
Q5	2N3641 or equiv. (for +ve
	earth tape recorder)
	2N3645 or equiv. (for -ve
	earth tape recorder)
IC1	4049 or equiv.
IC2	'555
IC3	4518
IC4	4070 or equiv.
	And the second s

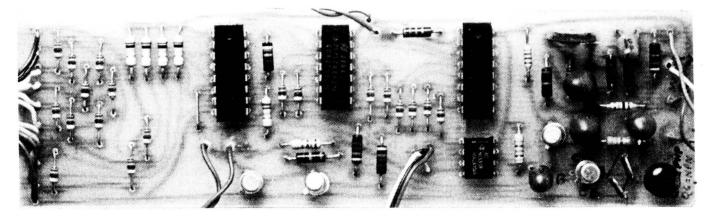
Miscellaneous

S	W1	.single pole, 10 (or 12)
		position
P	B1	.SPDT ultra miniature push
		button

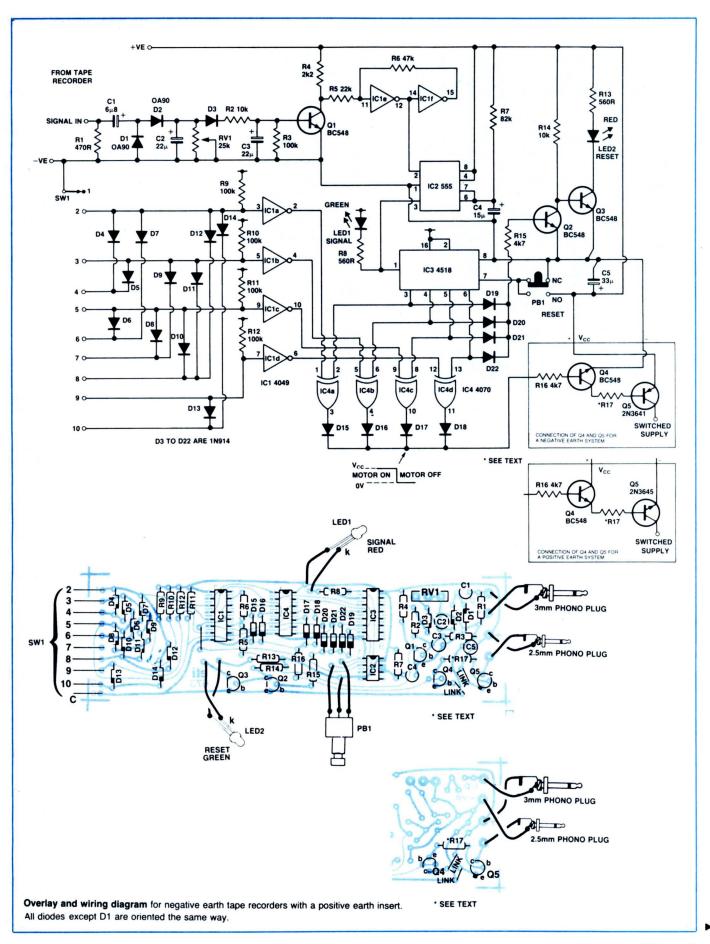
ETI-693 pc board; Scotchcal front panel; knob; mounting bezels for LEDS; zippy box (50 x 90 x 150 mm); 2 phono plugs 2.5 mm and 3.5 mm (or plugs to suit tape recorder); 150 mm length of rainbow cable; 800 mm length of suitable plastic sleeving to house 4 connecting wires between unit and tape recorder.

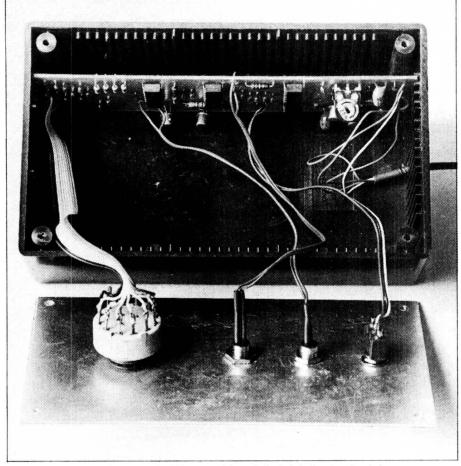
Price estimate: \$30-\$35 (not including tape recorder)

For a guide to components and kits for projects, see SHOPAROUND this issue.



The pc board. Check the polarity of the tape recorder before mounting transistors.





The board in the box. The wires should be passed through the hole in the zippy box before connecting them to the board.

length of 3 mm plastic tubing, and then separated the wires to fan out into two short lenghts of 2 mm tubing. A piece of heat-shrink tubing then joined the lot, and a neat looking lead resulted. The important thing, however, is to connect the plugs to the pc board correctly. Note that the wires pass through a hole in the bottom of the zippy box, so pass the wires through this hole before connecting them to the board.

With all the wiring completed, the LEDs and switches can now be mounted on the front panel. Use of the design for a Scotchcal front panel will make for a professional looking unit, with the Scotchcal label being placed on the top cover of the 50 x 90 x 150 mm zippy box, and the holes duly drilled in the cover. The circuit board is designed to slot into the zippy box, with the lead to the plugs exiting the box through a hole drilled in the bottom. Some form of restraint should be attached to the lead to prevent it from being pulled, and exerting pressure on the connection points to the pc board. Finally, check over the job, mainly to confirm the correct orientation of the diodes, capacitors, ICs and transistors.

Testing

When you are convinced that the moment of truth has arrived, plug the unit into the tape recorder, set the volume and tone controls (treble) to maximum, set RV1 to its maximum resistance, turn on the power, and press the reset button. The reset LED should light, and the signal LED should not.

If this is not the case, that is, neither LED is lit, check with a voltmeter to see if power is being applied to the circuit correctly, if at all. This is easily done by looking across pins 1 and 8 of the '555, IC2, with pin 1 being the negative, and pin 8 the positive. If power is present and correct, check the connections of the reset LED. If this is OK, put on your fault finding hat, and read the 'How it works' section to find out the problem.

Once you have the correct condition, place a cassette into the player, (use one that has a signal on it, of course), and select, say track 2. Set the player into motion, (fast forward, with the head in contact with the tape, or PLAY and CUE keys on RQ-2133), and confirm that the tape player motor runs. At this point, measure the collector-emitter voltage of Q5. This voltage should be less than 0.8 V. If this is not the case, but the motor is running, reduce the value of R17 from the suggested value of 330 ohms to a lesser value. If this still does not drop the voltage sufficiently, reduce the value of R16. If the motor isn't running at all, determine why. Check, for example, that the voltage on the diode side of R16 is about 0.6 V less than Vcc. If not, suspect the logic.

If the motor runs, note that when the signal on the tape reaches the play head, the signal LED lights, and the reset LED remains on. This LED will go out when the counter is incremented past 0. If the signal LED doesn't light, confirm that there is in fact an output by listening to the signal from the player. Otherwise, confirm that RV12 is at maximum, and if so, follow the signal path with a voltmeter.

If Q1 reads Vcc at its collector when the signal is being fed into the auto-search input, the problem is before Q1; if the collector voltage of Q1 is around, say, 0.5 V, check the circuit after Q1. As a guide, the prototype showed a voltage of around 2.5 V dc across C2 when signal was applied to the auto-search from the cassette player. If the system is performing correctly up to this point, it now remains to confirm the setting of RV1, and the player's volume control.

The unit will work satisfactorily with either digital or analogue recordings. Analogue recordings are more critical because of variations in signal level. Dealing first with digital recordings, experiment with the controls, trying for example, to set RV1 half-way, and the volume control about one third of maximum to test to see that the system registers the gaps as well as the recorded sections. Confirm that data registers towards the end of the tape, particularly short programs. The signal LED should go out during the gaps, and be on during signal conditions.

If setting the volume control more critically doesn't help, you may have to reduce the value of either R7 or C15 to allow the timer to reset more quickly. Alternatively, ensure that programs have a reasonable length, made up with a leader tone, if necessary, or that gaps between each program have a duration of around 10 to 20 seconds.

If you wish to use the unit to search analogue tapes, set RV1 to its maximum resistance. Because analogue signals vary in level, often with quiet passages, things become a little more difficult for the autosearch to recognize a gap. The time constant of C3 and R3 is set to give a delay to allow short passages of low or no signal to be ignored. Increasing this time constant will allow short gaps in the signal to be passed over, but some care has to be taken to ensure that the time delay is not so long that gaps at the end of the tape are ignored. Again, the best rule is to ensure that gaps of 10 to 20 seconds exist between each selection.

One final point concerning the National RQ-2133. I found when trying another of these players, that pressing the PLAY and CUE keys to their locked position caused the play head to not be in sufficient contact with the tape to allow adequate output. By

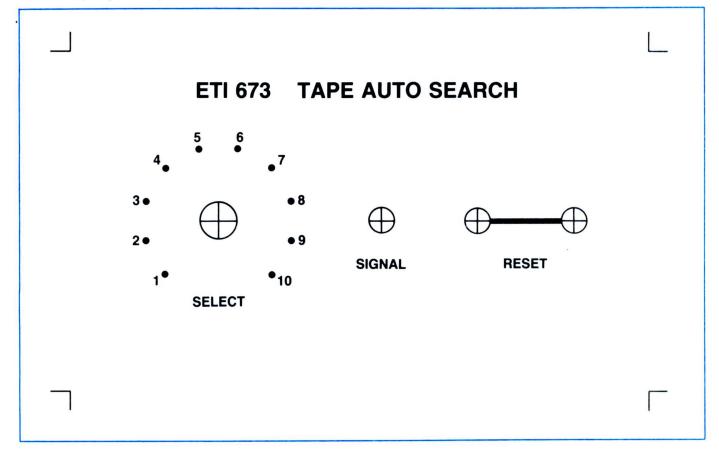
bending or filing a stop lug associated with the mechanism, this problem was fixed. If you are buying one for the purpose of this article, listen to the particular unit with the keys actually locked down, rather than just held down, and buy the one that gives the best output. Otherwise, gently disassemble the mechanism, and modify the stop lug.

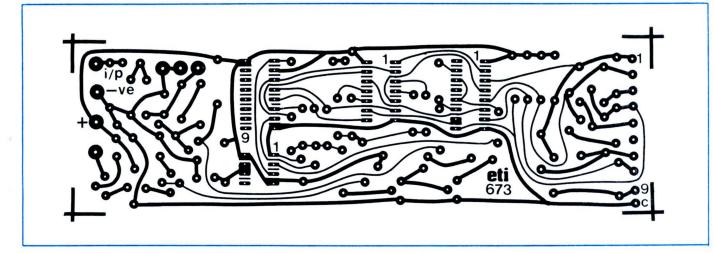
This tape recorder also allows for searching in reverse, by pressing the PLAY and REVIEW keys together. Again, you may

have to fiddle with the mechanics if you want this feature.

Pressing the reset button after 10 selections have been passed resets the counter to 0. It is possible to have as many items on the cassette as you wish by repressing reset, and adding 10 each time. If you are adventurous, this simple system can be upgraded to allow modifications to permit, for example, the inclusion of a switch to transfer the signal to the computer, using the cassette

player to play out the program without having to unplug the auto-search. This switch could even be electronic, actuated by the output of diodes D15 to D18, (taking advantage of the fact that this output level is a logic 0 when the cueing has taken place). Other possibilities could include interfacing the cassette to the computer and providing the mechanics can be suitably modified, using the cassette player under software control.







289 LATROBE STREET, MELBOURNE 3000 PH. (03) 602 3499 887 SPRINGVALE ROAD, SPRINGVALE 3171 PH. (03) 547 1046

8.30am-5.30pm MON-THURS;

8.30am-8.00pm FRIDAYS

9am-12noon SATURDAY

ALL YOU HAVE EVER WANTED IN AN ELECTRONIC STORE - AND MORE!

NOW OPEN - NEW SPRINGVALE STORE



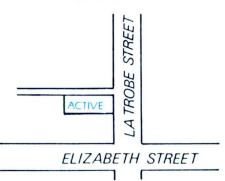
ACTIVE ON THE MOVE

VERBATIM OPENING SPECIALS

DS DD \$35.50

ACTIVE'S 2 GREAT LOCATIONS - NOW AT





CITY

MAIL ORDER

(03) 671312

POSTAGE RATES

\$1-\$9.99				\$1.50
\$10-\$24.99				\$2.00
\$25-\$49.99				\$3.00
\$50-\$99.99				\$3.50
\$100-\$199.				\$5.00
\$200-\$499.				. 7.50
\$500 plus .			9	10.00



MAIL ORDERS LA TROBE STORE ONLY



289 LATROBE STREET, MELBOURNE 3000 PH. (03) 602 3499 887 SPRINGVALE ROAD, SPRINGVALE 3171 PH. (03) 547 1046

8.30am - 5.30pm MON-THURS 8.30am-8.00pm FRIDAYS 9am-12noon SATURDAY
ALL YOU HAVE EVER WANTED IN AN ELECTRONIC STORE – AND MORE!

AUSTRALIAN MADE DO IT YOURSELF BURGLAR ALARM.

PROTECTS YOUR HOME, OFFICE & FACTORY.

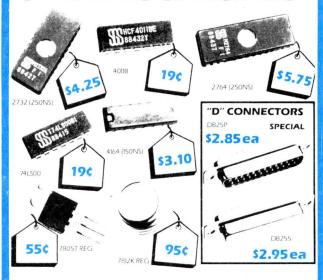






COMES IN CONVENIENT CARRY CASE.

SEMICONDUCTOR OPENING SPECIALS!



TOP BRAND MITSUBISHI MONITORS

AVAILABLE



GREEN NV1290 x AMBER NV1290 x

\$210

\$215

ACTIVE - JUST ABOUT EVERYTHING ELECTRONIC

babani books

Essential Theory for Hobbyists	A0013B
International Transistor	
Equivalents Guide	B0018B
Power Supply Projects	D0047B
Electronic Household Projects	D0048B
Electronic Projects Using	TRICK D.
Solar Cells	D0049B
Digital IC Projects	D0050B
28 Tested Transistor Projects	D0053B
Model Railway Projects	D0054B
Projects in Opto-Electronics	D0057B
Single IC Projects	D0058B
Popular Electronic Circuits	
Book 1	D0060B
Popular Electronic Circuits	
Book 2	D0061B
Mini Matrix Board Projects	D0062B
Multi Circuit Board Projects	D0063B
Aerial Projects	D0064B
Modern Op-Amp Circuits	D0065B
Electronic Projects	
for Cars & Boats	D0067B
Build Your Own Electronic Lab	D0384B
52 Projects Using IC741	D0386B
50 FET Projects	E0069B
How to Use Op-Amps	E0092B
50 Projects Using	
CA 3130 IC's	E0101B
Practical Introduction	E0400D
to Digital IC's	E0102B
50 Circuits Using Zener Diodes 50 Circuits Using	E0103B
7400 Series IC's	E0111B
VMOS Projects	E0112B
Mobile Disco Handbook	G0093B
Introduction to Video	G0093B
Audio Projects	G0124B
Practical Construction of	G0134B
Pre-Amps	G0137B
Practical Transistor Novelties	G0382B
Audio Enthusiasts Handbook	G0383B
The 6809 Companion	J0154B
Practical Computer	00.012
Experiments	J0172B
Add-on Projects for Spectrum	
ZX81, Ace	J0285B
Art of Programming 1K ZX81	K0226B
Electronic Calculator Users	
Handbook	M0245B
Your Calculator & Your Money	M0246B
Fun & Games with Your	
Calculator	M0370B
Radio Stations Guide	N0252B

\$2 each or ANY 6 for \$10 special offer

BOOKS

computer hardware and techniques

MICROPROCESSOR CIRCUITS J0157P

\$14.75

Presents basic microprocessor concepts in simple language for beginners and teaches you to construct a useful microcontroller system. Offers 30 demo circuits which take you through assembly, operation and programming of a microcontroller.

THE \$100 AND OTHER MICRO BUSES J0160P

\$14.50

The key to successful computer expansion is a complete understanding of the bus system, through which the computer communicates with peripherals. This book will give you that understanding.

MICROCOMPUTER DESIGN AND TROUBLESHOOTING

J0161P Tells you how to design microcomputer systems and make them work without an expensive com-mercial development system or the need for costly test instrumentation. Includes a complete description of two microprocessors - the 8085 and the

MICROPROCESSING INTERFACING **TECHNIQUES**

J0167A

Teaches you how to interconnect a complete microprocessor system and interface it to the usual peripherals. The hardware and software skills needed to effectively interface peripheral devices are covered along with various buss standards and A/D conversion. Third edition.

MICROSOFT BASIC

\$24.50

Presents a complete introduction and tutorial on programming in BASIC using Microsoft BASIC, Release 5.0. Covers branching and loops, strings, editing, arrays and files, and arithmetic in BASIC.

A Z80 WORKSHOP MANUAL J0283B

\$8.95

Intended for those who want to progress beyond BASIC programming to topics such as machinecode and assembly language programming or who need hardware details of the Z80-based computer.

USING THE OSBORNE 1 COMPUTER \$21.50 J0327H

How to get the most out of the Osborne 1 portable computer

6809 MICROCOMPUTER PROGRAMMING AND INTERFACING, WITH EXPERIMENTS

J0170P \$21.95

Gives a solid understanding of how to program and interface the high-performance 6809 microprocessor. The author completely explores internal structure, addressing modes, data movement instructions, registers, arithmetic logic and instructions for the 6809.

HOW TO PROGRAM AND INTERFACE THE 6800

\$22.95 J0303P An in-depth introduction to microprocessors and microcomputers in general and the Motorola 6800 microprocessor family in particular. Includes experiments for the Heath ET3400 and Motorola MEK6800D2 learning systems designed to demon-

strate 'real world' applications. Limited supplies. **Z8000 CPU USER'S REFERENCE MANUAL**

J0337H Though written as a manual for Zilog's microprocessor, this text is also applicable to the Z8001 and Z8002 microprocessors. Includes

overviews of architecture, address spaces, CPU operation and external interfacing.

16-BIT MICROPROCESSORS J0342P

A guide to the most popular of the 16-bit microprocessors, including the Intel 8086, the Zilog Z8001 and 8002 chips, the DEC LSI-11, Texas Instruments 9900, the Motorola 68000 and the National Semiconductor 16000 family.

PET INTERFACING

J0169P

Demonstrates how to build numerous interfacing devices for PET hardware. BASIC language programs are used throughout, and the book includes a discussion of the microprocessor's internal architecture and general hardware/software interfacing.

EXPERIMENTS IN ARTIFICIAL INTELLIGENCE FOR SMALL COMPUTERS

J0168P

Artificial intelligence is the capability of a device to perform functions normally associated with human intelligence. With this book, a small computer with extended BASIC and some knowledge of BASIC language, you can conduct experiments in artificial intelligence.

STD BUS INTERFACING

J0164P \$21.75 Explains what the STD bus is, in easy-to-understand language

electronics for beginners

BEGINNER'S GUIDE TO BUILDING **ELECTRONIC PROJECTS** C0030B

\$6.95

Enables total beginners to tackle electronic projects. Includes component identification, tools, soldering, building methods, cases, legends, etc., etc. Practical basic projects are included

BEGINNERS GUIDE TO BUILDING ELECTRONIC **PROJECTS**

COO30B

Enables total beginners to tackle electronic projects, includes component identification, tools, soldering, building methods, cases, legends, etc, etc. Practical basic project are included.

Prices subject to change without notice

ORDER TODAY - Simply return the Freepost reply card to:

SPECIAL INTEREST TO OUR READERS.

computers for beginners

PROGRAMMING FOR REAL BEGINNERS: BOOK

HO344A

Written for complete beginners, this book assumes no previous knowledge of computing, and guides you gently through the initial stages of building up simple programs. The text is written to be non-machine-specific, and so can be used with any micro that is programmable in BASIC.

PROGRAMMING FOR REAL BEGINNERS: BOOK

HO387A

This book introduces you to the stages involved in planning a program, including the use of flowcharts, and explores the wider range of facilities the computer has to offer. You'll also learn to plan your screen displays attractively to make your programs really user friendly.

ATARI PILOT FOR BEGINNERS

H0308H

\$21,95

Shows how to make the Atari 400 and 800 home computers play music, display colourful moving ctures and do mathematics. Shows how to use the Pilot computer language.

FOUNDATIONS OF COMPUTER TECHNOLOGY H0312P

A thorough introduction to computer technology for business people, engineers, professionals, stu-dents and hobbyists. Assumes no prior knowledge of computers, electronics or mathematics.

MODERN COMPUTER CONCEPTS

H0313P

\$29.95

The second volume in this series (following ETI Book Sales No. H0312P) covers subjects such as semiconductor memory devices, central processor units, magnetic memories, datacommunications, computer networks and videotex.

DON'T (OR, HOW TO CARE FOR YOUR COMPUTER)

H0153A

A guide to computer and peripheral preservation. Specific advice for the computer, floppy disks, hard disks, the CRT terminal, the printer, tape units, the computer room, software and documentation.

COMPUTERS FOR EVERYBODY H0270A

In this easy-to-understand book it is explained how a computer can be used at home, in the office or at school. Includes a consumer's guide to computer equipment that will help the reader decide what to buy and who to buy it from. Second

YOUR FIRST COMPUTER

H0271A

\$15.25

An easy-to-understand beginner's book to small computers. Understanding them, buying them and using them for personal and business applications.

MICROCOMPUTERS: A PARENTS' GUIDE \$13.75

H0275J

In clear, non-technical language, the authors explain what micros are, what they can do and what to expect in the future.

HART'S DICTIONARY OF BASIC

H0276J

Contains more than 800 entries which summarise the actions of almost every statement, command or function you are ever likely to meet. Each entry is explained in plain English, not computerese.

COBOL FOR BEGINNERS

H0140H

It is a solid text for introductory programming courses in Cobol, using a format that is easy to understand, yet comprehensive enough to make supplementary readings unnecessary.

circuit techniques and design

BUILD YOUR OWN HI-FI AND AUDIO ACCESSORIES D0052B

\$4.95

Essential for keen hi-fi and audio enthusiasts. Projects include stereo decoder, three-channel mixer, FET preamp for ceramic pick-ups, mic preamp with bass, stereo dynamic noise limiter, loudspeaker protector, etc.

RF CIRCUIT DESIGN

E0079P

\$36.95

A practical approach to the design of RF amplifiers, impedance-matching networks and filters. Uses a minimum of complex maths.

GUIDE TO CMOS BASICS, CIRCUITS, AND EXPERIMENTS

E0107P

\$15.95

If you are already familiar with TTL devices and are ready to examine the benefits of CMOS, this book is your complete source. It tells you what CMOS devices are, their characteristics and design rules. Experiments demonstrate the concepts dis-

ELECTRONIC DESIGN WITH OFF-THE-SHELF ICs

E0099H

\$15.70

It contains virtually all the information you need to design and build electronic circuits, systems and subsystems with readily available ICs. Shows how to interface them into highly complex systems.

MODERN FILTER DESIGN

E0100H

This book details the advances in active RC filters, both from a practical standpoint and from a stateof-the-art point of view. Gives detailed analysis and design procedures for switched capacitor filters.

Prices subject to change without notice

computing software

FORTH PROGRAMMING

K0298P

Describes both Forth-79 and fig-Forth and shows how to write software using these languages, add new operations (words) and manipulate the stack. Includes more than 50 useful programs.

COMPUTER PROGRAMS IN BASIC

K0192H

Fully indexed guide to more than 1600 BASIC programs published in personal computer magazines for microcomputers, computers and mainframe computers. Compiled by Paul Friedmann, first published in 1981.

6502 APPLICATIONS BOOK

K0228A

\$20.95

Use this book and a few low-cost components to build a complete home alarm system, an electric piano, a motor speed-regulator, a time-of-day clock, a simulated traffic control system and a Morse code generator, etc.

6502 GAMES

K0229A

\$21.95

You learn how to play 10 sophisticated games and also learn assembly language programming. Also learn the techniques of algorithm design and data

PROGRAMMING THE Z80

K0231A

\$26.95

This book will enable every reader to write complete application programs for Z80-based computer systems. Includes exercises to measure progress and comprehension at each level of programming

PROGRAMMING THE Z8000

K0232A

A complete introduction to programming concepts and techniques for use with the 16-bit, Z8000 microprocessor. Presents detailed descriptions of the architecture and functions of this 'super chip'.

APPLE II ASSEMBLY LANGUAGE

K0195P

\$23.45

Teaches assembly-language programming at the beginning level — no prior knowledge of 6502 assembly language is needed. Includes hands-on computer exercises and experiments, with both software and hardware. Provides interfacing circuits and programs that can be used on the Apple Il without modification.

QWIKTRAN

K0196A

Quick Fortran for micros, minis and mainframes. Starts with the basic concepts of computing and Qwiktran, a fundamental subset of Fortran IV. Lots of examples to increase the reader's proficiency.

THE C PROGRAMMING LANGUAGE

K0272H

\$26.95

is a general purpose 'low-level' programming language. It is not specialised to any particular area of application, but its absence of restrictions make it convenient and effective for many tasks.

TRS-80 ASSEMBLY-LANGUAGE MADE SIMPLE

K0208P

\$19.25

If you have an understanding of BASIC programming, this will help you to plan, write and handassemble your own assembly-language programs in memory, using the T-bug and Level II BASIC ROM subroutines.

ATARI GAMES AND RECREATIONS

K0224H

\$22.25

Beginners and advanced users can use the preprogrammed games in this book to improve their skill. Charts, flash cards, an error dictionary and graph paper designs are among the features.

PROGRAMMING IN BASIC FOR PERSONAL COMPUTERS

K0186H

Simple instructions show how to give BASIC commands and statements a wide range of applications, from programming video games to developing business or scientific programs.

BASIC FOR EVERYONE

K0187H

\$22,40

Some 350 pages of BASIC information for all

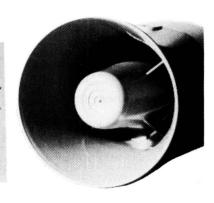
FEDERAL MARKETING BOOK SALES

PO Box 227, Waterloo 2017, NSW

More BOOKS of Special Interest on page 72

HOME BURGLAR ALARM eti * eti * ALARM DIAGRAPI BURGLAR BURGLA

Part 2



Securing your home takes some careful thought and preparation. Once you've built your ETI-1527 burglar alarm you need to determine your exact needs and use a little camouflaging ingenuity for installation.

Robert Irwin

LAST MONTH I described the design and construction of the ETI-1527 burglar alarm. The following paragraphs are intended as a guide to those hardy adventurers who wish to install their own burglar alarm system. Although primarily intended for use with the ETI-1527 burglar alarm module the comments are mostly general and may help those of you who, perish the thought, are using an alternative control module.

Sensors

Firstly, let's have a look at the types of sensors available. The most commonly used type of sensor is the 'switch' or 'contact' type of detector. The favourite from this

group is the magnet reed switch which uses the proximity of a small magnet to operate a reed relay. These are mainly used to detect the opening of a door or window.

In such cases the relay is mounted on the door or window surround and the magnet is mounted on the moving section in such a way that when the door or window is closed the magnet and reed are in close proximity and the reed switch is kept closed. When the door or window is opened the magnet will be moved away from the reed and the relay will drop out thus breaking the circuit.

The magnet reed switch has the advantages of being cheap and relatively easy to install. If installed correctly and used correctly the magnetic switch is also reasonably resistant to false alarms.

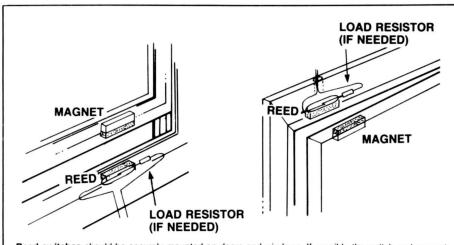
The one major disadvantage is that it can be fairly easily circumvented by someone who knows how. By clever mounting and disguising, however, this problem can be minimized.

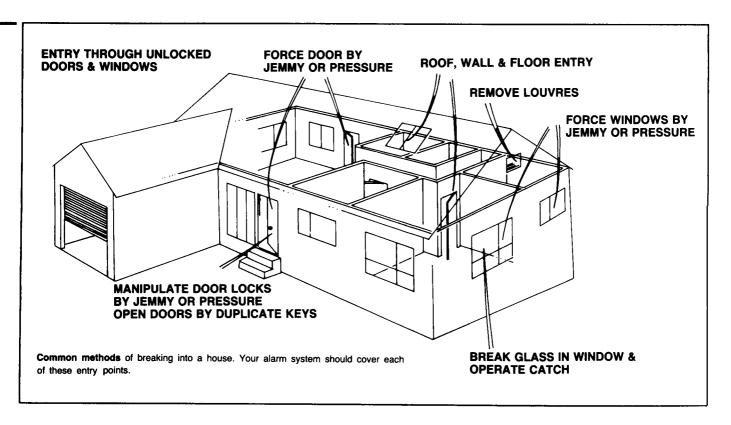
An example of a mechanical contact switch is a plunger or lever operated switch. These switches operate in a similar way to the switch that operates the courtesy light on your car when you open the door. The physical action of opening a door or window actuates a plunger or arm to throw a switch. These types of switches are used in similar applications to that of the magnetic reed switches

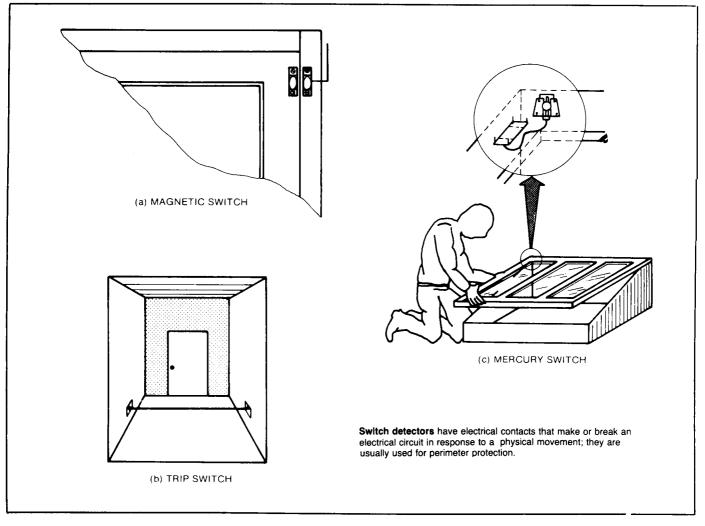
A mercury tilt switch can also be used to detect entry through windows which pivot upwards to open. These switches use a drop of mercury to make electrical contact between points in a sealed glass bulb. The switches have the disadvantage that they can easily be set off if the wind unduly rattles the window and should only be used when this sort of problem could not occur.

Another type of contact switch which is not used on doors or windows is the pressure mat. These are large flat mats with electrical contacts inside. These respond to the pressure of someone walking on them and can be hidden under carpets or rugs and can be placed in hallways or in such a position that someone attempting to take a valuable item, such as your TV, will have to tread on the pressure mat first.

One form of detector which is commonly used where large glass areas need to be protected is metallic foil. This comes in the form of metal foil tape which is stuck on a window or glass door and then connected







MPARISON OF IN	TRUDER DETECTORS			-	
Detector	Applications	Advantages	Limitations	Resistance to defeat	False alarm susceptibility
Contact mechanical switches	Doors, windows, gates, transoms, hatches, etc. Usually for perimeter protection	Low cost	Low reliability. Low sensitivity. Subject to environmental effects. High installation cost	Low	High if door or window has large amount of play; low if tight
Magnetic switches	Doors, windows, gates, transoms, hatches, etc. Usually for perimeter protection	Relatively resistant to environmental effects. Relatively immune to effects of wear.Low cost	to damage in some applications. High	Balanced type more resistant to compromise than single magnet types	High if door or window has large amount of play; low if tight
Mercury switches	Same comments as for ma open with changing v	agnetic switches ap vertical angle thus	ply. Application is usually these switches operate w	for access points the hen tilted beyond a	at have covers that a certain point
Metallic foil	Show windows, office windows, glass doors, dry wall board, etc. Usually for perimeter protection	Visibility serves as deterrent	Vulnerable to damage both intentional and through day-to-day use. Must be replaced if damaged	Low	High due to effects of environment
Pressure mats	Small areas, doorways, or under specific objects for point protection	Low cost. Low degree of maintenance. Adaptable to wide variety of shapes and sizes	Subject to wear if in path of heavy foot traffic. Subject to effects of humidity and standing water	Low	Subject to environmental conditions
Acoustic detector	Area protection of enclosed spaces (rooms, vaults, etc), glass breakage detectors	Not affected by air movement	Must be used in stable noise environment where background level is low	High if properly installed	Can be high depending on the type and application
Ultrasonic motion detector	Area protection of small enclosed spaces (rooms, corridors, etc)	Easy physical installation for large volume protection. Effective against 'stay behinds'	Can be affected by environmental factors, air turbulence and motion	High if properly installed	Can be high unless environ- mental factors are considered before application
Microwave motion detector	Area protection of enclosed spaces (rooms, corridors, etc). Can cover large areas	Easy physical installation for large volume protection. Effective against 'stay behinds'	Needs care in position- ing and adjustment to avoid detection beyond required area	High if properly installed	Can be high unless properly placed and carefully adjusted
UHF radio motion detector	Area protection of enclosed spaces (rooms, corridors, etc). Can cover large areas	Easy physical installation for large volume protection. Effective against 'stay behinds'	Needs care in position- ing and adjustment to avoid detection beyond required area	installed	Can be high unless properly placed and carefully adjusted
Passive infrared motion detector		Easy physical installation for large volume protection. Effective against 'stay behinds'	Can be affected by changes in thermal environment	High if properly installed	High for receive only sensors
Capacitance detector	Primarily point protection for safes, filing cabinets, valuable objects	Detection field confined to the specific object	Can be applied only to objects not electrically grounded. May require special construction	installed	Low if properly installed
Vibration detector	Primarily point protection for safes, vaults, show cases, etc. Limited to perimeter protection when installed to protect walls or ceilings, etc	Requires low maintenance. High degree of reliability when properly applied	Detects only forceful attempts at entry. Cannot be used in areas of high vibration (traffic, construction, etc)	High if properly installed	Can be high if environmental factors are not taken into account. May be triggered by minor earth tremors, sonic booms or trains

back to the alarm.

If the window is broken, the foil will break and thus break the electrical contact. The problem with metal foil is that it can easily be damaged by routine cleaning of the window. A protective coating is generally put over the foil after it is attached to the window to get round this problem.

All of these sensors rely on an intruder opening, tilting or in some other way physically disturbing the protected area.

If the intruder gains entry to the premises without setting off these detectors the following group of sensors can be implemented. These consist of several different types of motion detector.

The main types use either microwave,

radio wave, ultrasonic or infrared energy to detect the motion of an intruder in a specific area. Each type of sensor works on different principles and has different properties. Therefore, despite the fact that they all detect the same thing, their individual suitability to a particular situation will vary.

Microwave detectors use a high frequency electromagnetic field to sense motion. They require both a transmitter and a receiver to operate. The shape of the field can be made either directional or omnidirectional and each manufacturer will have different specifications on field pattern and range.

Since microwaves will penetrate most building materials (wood, glass, plastic)

these detectors must be mounted with care to ensure that their range does not exceed the desired area. Otherwise the sensor may pick up motion outside the building and cause a false alarm.

This penetration power of microwaves can, if you are careful, be used to advantage. The sensor can be mounted inside a wall cavity or cupboard and still protect the desired area.

In complete contrast, ultrasonic motion detectors will not penetrate walls and can therefore, be completely contained in a room. Their use, though, still requires much care to be effective as this lack of penetration means that large objects, such as a lounge, can create blank spots in the room where the ultrasonic field will not penetrate.

Any obstructions in the room, such as an intricate chandelier, may distort the field and make it less effective. As with the microwave sensor, the ultrasonic sensor needs a transmitter and receiver.

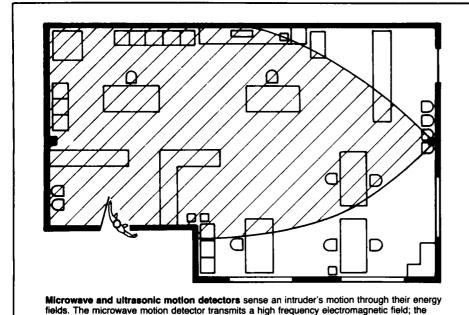
Radio frequency motion detectors generate a field of UHF radio waves. The generated power changes when a moving object enters the field and thus these detectors do not need a receiver. The field is omnidirectional and has a penetration power better than that of microwave detectors so extra care must be taken.

UHF radio sensors are quite often used to give coverage of two or more rooms at the same time. It should be noted that these waves will not penetrate metal. The power of these detectors is usually variable and coverage areas of up to 20 m diameter are usual. Due to the penetration and reflection off metal surfaces, the actual field shape in a particular application is unpredictable and is usually adjusted by trial and error.

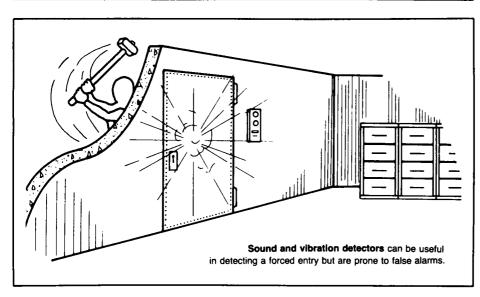
One of the most common motion detectors is the passive infrared sensor. These sensors detect the presence of a moving infrared source. Ambient temperatures or stationary heat sources will not set the detector off but the heat from a human body will at a range of up to 10 m. This type of detector uses the difference between room temperature and body temperature so on very hot days in a hot room the range can be severely limited.

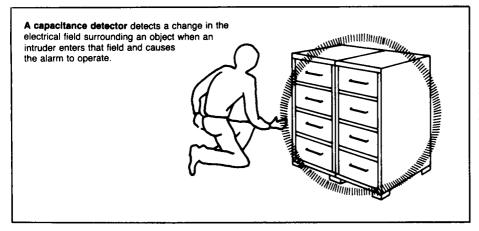
Infrared systems use optical focusing to tailor the coverage of the sensor and so are limited to line of sight. This can sometimes be a problem in odd shaped rooms or areas with large objects in them which may obscure the view. Being passive detectors they do not emit any field of their own and so, unlike all the other motion detectors, they cannot be detected.

Some special types of sensors are available for special applications. Sound and vibration detectors can be used to detect someone trying to break or cut through a wall. These are very prone to false alarms if not mounted in a place where they will not



ultrasonic motion detector transmits a high frequency sound field.





pick up sound or vibration from traffic in the street or other common disturbances.

For protection of safes or filing cabinets a capacitance detector can be used. These sensors will detect the change in capacitance when an intruder approaches a metal object such as a safe.

The above is a summary of the more common types of detectors used. It is wise to check out the manufacturers for information regarding particular products. If you decide to use infrared motion detectors, for instance, do get some information about the different brands as each will have different specifications. One type may be more suited to your application than another.

Defining the security problem

The first thing to do when you are thinking about installing a burglar alarm system is to take a good look at the premises you are trying to protect and to isolate the problem areas.

Start with the doorways. If your front and back doors are solid and well mounted and have a good deadlock correctly installed then there is little need to have advanced security measures on these. A magnetic reed switch correctly mounted should be adequate protection. If the doors contain glass panels then metal foil could be used on these. If the door is not all that secure then perhaps use a pressure mat under the carpet inside the door to give added protection.

The next problem area (and often the most neglected) is windows. Most people spend large sums of money putting expensive deadlocks on their doors but have no adequate locking facilities on the windows. In the majority of break-ins the intruders enter through inadequately secured windows or doors either by simply opening them because they weren't even locked or by jemmying them open because the locking devices (or hinges) weren't secure enough.

The golden rule here, is to make sure your windows can't easily be forced open and to make sure you lock them when you go out. If you are not sure then take a jemmy bar and play criminal (to your own windows not the neighbours!!!). You may be surprised at how easy it is to get in!

As far as electronic security for your win-

dows goes, well installed magnetic reed switches can be used to great effect. If you wish, metal foil can be used to protect against someone breaking the glass.

Another method of entry that is sometimes overlooked is through the roof. Quite often a burglar may simply take a few tiles off the roof and crawl in. It is then no trouble to enter the house through the manhole. A reed switch on the manhole cover can protect against this form of entry. Any skylights or such that may afford entry should be protected as well.

The bottom line is to try to make your house as secure as possible before installing a burglar alarm and then use the alarm to strengthen any weak points that may be left.

So far I have only talked about perimeter protection or in other words, detecting an entry into the house. If the burglar gets in without setting off an alarm then area protection can be used.

This is where the motion detectors come in. These can be positioned to detect anyone moving in a room or corridor. The particular type of motion detector used is up to you. It will depend on the size and type of room you wish to cover. If in doubt seek some advice on the pros and cons of each device for your particular application. Whichever detector you choose don't forget to thoroughly check that it is not being triggered by movement outside the designated area.

The complexity of the sensor system is really up to you. The ETI-1527 can support all of the sensors mentioned above and each sector can have a number of sensors attached. Although it may be tempting to put a maze of reed switches, pressure mats and motion detectors in your house, remember that the more sensors you use the more chance of false triggering you'll have. With a bit of planning you should be able to minimize the sensors necessary to provide complete coverage for your house.

Installation

Firstly, you will have to decide where and how you are going to mount the control module. Several options are open. You can mount the module and power supply in a security type box and then mount the box on a wall somewhere. If you take this approach then make very sure that it is extremely difficult to break into the box or cut any wire coming from the box. The easiest way to do this is to run any exposed wires in metal conduit which is securely attached to the wall.

Another way is to conceal the control module in a closet or other such place. If you do this then make sure that it is not going to be obviously discovered by a mass of wires emerging from the hiding place. If you are going to hide the module then a security box is not necessary but some form of box should be used to protect the electronics.

The power supply will also have to be mounted in a box for safety as any mains wiring should be completely insulated and kept safe from accidental touching. If you are very adventurous you may even think of mounting the control unit in the wall. If you wish to do this then you are a better handyman than me so I won't even presume to give you any advice.

No matter which way you choose to mount the module you will need to make sure that there is easy access to a power point that the alarm can remain permanently attached to. Also the module itself should be reasonably easy to access so that you will have no trouble getting to it to either arm or disarm.

You will also need to be able to easily read the display when arming the alarm so that you can check the status of each sector. Once you have chosen the site for the control module, it is wise to allow for a sensor which will trigger the alarm if the intruder opens the closet or box that the alarm is in.

In mounting the sensors each type will present its own special problems. Motion detectors should have mounting instructions — follow these carefully. If you install a motion detector then you should do a thorough 'walk' test to ensure that the detector is not picking up in areas that it shouldn't.

Magnetic reed switches can be very effective and cheap sensors if mounted correctly. There are several things you should watch when installing them. The magnet should be mounted on the moving part of the door or window and the reed switch mounted on the stationary part.

If possible both parts should be mounted to conceal their presence. This can be done by recessing them into the woodwork. Both parts should be mounted securely and as close as practical. This will minimize the likelihood of false triggering when the wind rattles the door or window. If the door or window has a large amount of play in it then you should try to repair it so that it fits more tightly before installing the sensor.

Other types of sensors should also be concealed as much as possible. If the intruder doesn't know a sensor is there then he won't take steps to defeat it. Pressure

mats are easily hidden under carpets or rugs and may never be noticed if there are no tell-tale wires running out.

As far as wiring goes the golden rule is conceal the wires and make them as inaccessible as possible. Ideally wires should be run into the sensor via the wall cavities. If this is not possible then concealment under skirting boards and architraves will do. All wiring, as far as possible, should be done with good quality, heavy duty stranded wire to minimize voltage drops and rf pickup.

If it is necessary to run wires in the open (in the roof or under the floor) then the wires should be run in well secured metal conduit to prevent access. All joins in the wires should be securely soldered and insulated and connections should be as secure as possible to prevent them working loose and causing a false alarm. The load resistors needed on the inputs can be put anywhere in the circuit path but if possible they should also be conealed to prevent someone bypassing the sensors.

The alarm siren or bell is something that you should also pay attention to. There are various noise makers on the market and any security company should be able to show

you a few. A siren generator is built into the module so a simple horn speaker can be used.

Whatever you use you should mount on the outside of the building in an out of the way and inaccessible place. It should be mounted securely and if possible with a steel cover to prevent tampering. Any wiring to the siren should be made inaccessible either by running it in conduit or taking it straight through the wall. The alarm will be useless if the intruder can simply disconnect the siren. It is wise to use two separate sirens and mount them in different parts of the building.

Once you have installed your alarm give the whole system an extensive check. This is in both your own interests and your neighbours'. If your alarm system constantly puts out false alarms then the people around you will pretty quickly start ignoring the alarm. They may get upset about the noise so make sure the system is working reliably. If you find you are getting false alarms every time your fridge switches on or every time a taxi uses its radio near your house then you will probably have to add some suppression to the power supply lines and the input lines.

Remember

This article has tried to give a few general guidelines for installing your ETI-1527 module and sensors. If you want some additional information then ring around insurance companies and security agencies. The local police should also be able to put you on to any crime prevention authorities which will be able to advise you on any problems you may have.

It is important to understand that an alarm system is only one part of creating secure premises. You should inform your neighbours to the fact that you have installed an alarm system and organize for them to inform the police in the event of an alarm. You should also familiarize yourself and anyone else who will have access to the alarm of its correct usage. If used correctly and in conjunction with a few good door and window locks this alarm system should minimize your chances of being robbed. Beware, though, as some people who have spent a lot of money on extensive security alarms have found out. "The most sophisticated burglar alarm in the world is totally useless if you don't turn it on."

Master Electronics—Microprocessors—Now! The Practical Way!

- Electronics—Microprocessors—Computer Technology is the career and hobby of the future. We can train you at home in a simple, practical and interesting way.
- Recognise and handle all current electronic components and 'chips'.
- Carry out full programme of experimental work on electronic computer circuits including modern digital technology.
- Build an oscilloscope and master circuit diagram.
- Testing and servicing radio, TV, hi-fi and all types of electronic/ computer/industrial equipment.

AUSTRALIA SCHOOL OF ELECTRONICS P.O. Box 108, Glen Iris. 3146 Tel: (03) 523 5622.



NAME ADDRESS

SEND THIS COUPON NOW.

Please send your brochure without any obligation to:

I am interested in:

OR TELEPHONE US **(03) 523 5622** (24 HOUR SERVICE)

ETI 6/85

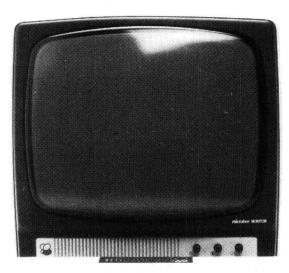
BLOCK CAPS PLEASE

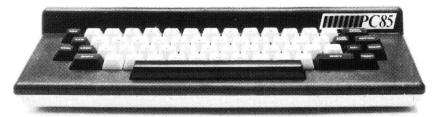
New Job? New Career? New Hobby?

ELECTRONICS
MICROPROCESSORS

SIBBLING

The microbee PC85 puts advanced computer technology in the hands of Hackers, Hobbyists and Horticulturalists at a cost below any competitors





The new microbee PC85 features a new high level of user friendliness. At the touch of a button you choose from a menu of built-in programs — Wordprocessing, Basic, A Calculator, Telecommunications and more. You can even have your own software built-in! Check out the new microbee PC85. You'll be impressed with the quality and surprised at the price.

Microbee PC85

\$499 incl. Tax

\$599 incl. Tax with Green Monitor Ask about Printers, Modems and more.

) bankcard PHONE ORDERS

in Australia by

ACCEPTED

microbee technology centres

1 Pattison Ave, Waitara 2077 Phone (02) 487 2711

729 Glenferrie Rd, Hawthorn 3122 Phone (03) 819 5288

141 Stirling Highway, Nedlands Phone (09) 386 8289

151 Unley Rd, Unley 5061, Phone (08) 272 1384

455 Logan Rd, Stones Corner, 4120 Phone (07) 394 3688

FACTORY

Koala Crescent, West Gosford 2250 Phone (043) 24 2711

HP and Electronics Today announce a limited time offer! This snap-in fibre optic kit for just \$33.00.

There's never been a better time than now to try fibre optics for short distance links. Because for a limited time, all you need to get started is \$33.00.

That's all it takes to get HP's HFBR-0500 Snap-In Link Evaluation Kit, including a complete working link with transmitter, receiver, five metres of plastic fibre cable with connectors attached, two spare connectors, polishing tool and technical literature. The connectors simply snap-in to the transmitter and receiver modules. It's easy. And attaching the connectors to cables is simple, too. Data rates up to 5 Mbaud and distances up to 22 metres are quaranteed over a specified temperature range.

The HFBR-0500 Kit normally sells for around \$57.00. But if you want yours for just \$33.00, act now. This special offer expires June 30. 1985.

Fibre optics are rapidly becoming the data link of choice for applications connecting computers to peripherals, and for industrial control applications. Once you see how easy and reliable fibre optics are, you may never go back to traditional wire cable!

Order your kit today! Please complete and send the coupon and your cheque to Federal Marketing, PO Box 227, Waterloo NSW 2017.

HP: The right choice for value in fibre optics.



nini ya	
20000	
	-

Yes! Send me HP's snap-in fibre optic evaluation kit.

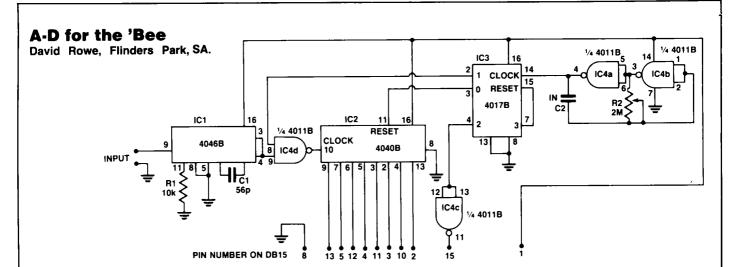
Enclosed is my cheque made payable to Federal Marketing for \$33.00.

Postcode Phone





IDEA OF THE MONTH



This simple Analogue-to-Digital converter circuit is reasonably linear with best results being between 0.5 V and 4 volts. Stability can be improved by using high quality components.

The circuit works by making the input control the frequency of the voltage controlled oscilla-

tor made up from the 4046. The input must be between 0 volts and 5 volts. The actual conversion is done by the 4040, which counts the number of pulses from the 4046 in a preset time frame. This is achieved by using the 4017. Sequence begins when pin 1 of the 4017 goes high, thus

allowing the buffer IC4d to pass clock signals to the 4040.

At the end of the time frame pin 1 goes low, blocking the clock pulses, and IC4c pulses the ASTB port on the 'Bee, thus strobing it to accept an input from the 4040. Then pin 3 of the 4017 sends a reset signal to the

4040 to begin the sequence once more.

The timing of this sequence is determined by the frequency of the oscillator made up from IC4a and 4b. The output from this clocks the 4017, which is an ordinary counter, wired here in a count to three mode.

'IDEA OF THE MONTH' CONTEST

Scope Laboratories, which manufactures and distributes soldering irons and accessory tools, is sponsoring this contest with a prize given away every month for the best item submitted for publication in the Ideas for Experimenters' column — one of the most consistently popular features in ETI Magazine. Each month we will be giving away a 60 W Portable Cordless Soldering Iron, a 240 Volt Charging Adaptor together with a Holder Bracket. The prize is worth approx. \$100.

Selections will be made at the sole discretion of the editorial staff of ETI Magazine. Apart from the prize, each person will be paid \$20 for an item published. You must submit original ideas of circuits which have not previously been published. You may send as many entries as you wish.

COUPON

Cut and send to: Scope/ETI 'Idea of the Month' Contest, ETI Magazine, P.O. Box 227, Waterloo NSW 2017.

Lagree to the above terms and grant Electronics Today International all rights to publish my idea in ETI Magazine or other publications produced by it if declare that the attached idea is my own original material, that it has not previously been published and that its publication does not violate any other copyright

Breach of copyright is now a criminal offence

Title of Idea	
Signature	Date
Name	
Address	
P	Postcode



This contest is open to all persons normally resident in Australia, with the exception of members of the staff of Scope Laboratories. The Federal Publishing Company Pty Limited. ESN. The Litho Centre and or associated companies.

Closing date for each issue is the last day of the month. Entries received within seven

days of that date will be accepted if postmarked to and including the date of the last day of the month

The winning entry will be judged by the editor of ETI Magazine, whose decision will be

final. No correspondence can be entered into regarding the decision.

The winner will be advised by telegram the same day the result is declared. The name of the winner, together with the winning idea, will be published in the next possible issue of ETI Magazine

Contestants must enter their names and addresses where indicated on each entry form Photostats or clearly written copies will be accepted but if sending copies you must cut out and include with each entry the month and page number from the bottom of the page of the contest. In other words, you can send in multiple entries but you will need extra copies of the magazine so that you send an original page number with each entry

This contest is invalid in states where local laws prohibit entries. Entrants must sign the declaration on the coupon that they have read the above rules and agree to abide by their

conditions

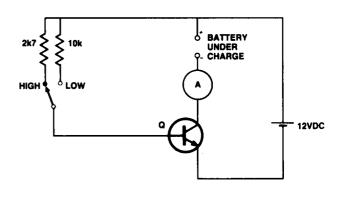
Nicad battery charger

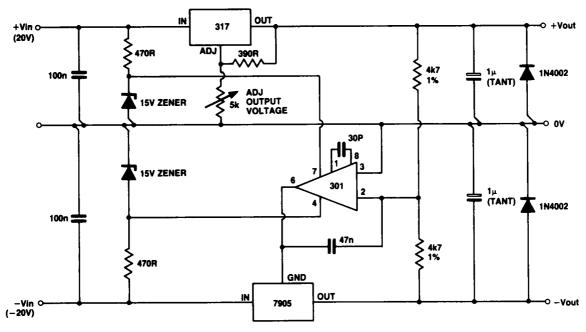
Noel Jackson of Wandin East sent us this Nicad charger. The switch selects a resistor to set the base current of the transistor, and the resulting collector current will charge the battery. Charging current will be reasonably constant irrespective of the number of cells in series being charged; up to 8 cells may be charged at the one time.

Once the circuit has been tested the ammeter could be omitted, or a multimeter switched to an appropriate current range could be plugged in to the circuit.

The 12 volts dc could be provided by a plugpack, or by a suitable 240 volt transformer and rectifier.

In theory, the collector current will rise as the transistor's temperature increases, but this was not noticeable in the prototype. The transistor could be mounted on a heatsink if desired. Exact values for the resistors will depend on the transistor used and the required charging currents.





Dual tracking power supply

This circuit from H. Nancinovich, Gulgong NSW, is for a dual power supply. It is particularly suitable for powering op-amp circuits which usually require both positive and negative supply voltages. The circuit consists of a positive regulator which gives a positive output voltage variable from 1.2 V to approximately 16.6 V, and a negative regulator which tracks the positive output voltage to give a negative output voltage of equal magnitude. The positive regulator comprises a 317 (µA317, LM317, etc.) IC which main-

tains a constant 1.2 V between its 'out' and 'adj' terminals. This voltage appears across a 390R resistor which, together with a 5k variable resistor, forms a voltage divider. The positive output voltage is equal to: 1.2 V $x (1 + \frac{1}{398})$ where R is the value of the variable resistor in ohms. The negative regulator comprises a 7905 IC regulator and a 301 IC op-amp. The 7905 maintains a fixed -5 V between its 'out' and 'gnd' terminals. Its 'gnd' terminal is connected to the output (pin 6) of the opamp. The latter compares the

voltage at the junction of two 4k7 resistors across the positive and negative output lines with that at the 0 V line and produces a proportional voltage at its output. The 7905 reflects this voltage (plus -5 V) into the negative output line. By negative feedback action, the voltage at the junction of the two 4k7 resistors is maintained equal to that at the 0 V line. Since these two resistors are equal, the negative output voltage is maintained equal and opposite to the positive output voltage.

The 1µ tantalum capacitors

across the outputs and the 47n capacitor between pins 2 and 6 of the op-amp ensure stability, while the 1N4002 diodes across the outputs protect the regulators against possible reversal of the output voltages (as may sometimes happen when coupled with other power supplies, for example). Both the positive and negative regulators feature current and thermal limiting, which features are built into the 317 and 7905 ICs.

We've got the kits at

LATEST KITS!



MULTI SECTOR ALARM STATION

Protect your home from intruders with this up-to-the-minute burgular alarm system, its easy to build, costs alarm system, its easy to build, costs less than equivalent commercial units, and features eight seperate inputs, individual sector control, battery back up and self-test facility. Specifications: Eight sectors with LED status

- attery back up ansept-feest facility-specifications with LED status indication.

 Two delayed entry sectors.

 Vanable exit, entry and alarm time settings: entry delay variable between 10 and 75 seconds; exit delay variable between 5 and 45 seconds; alarm time variable between 1 and 15 minutes.

 Pesistive loop sensing; suits both normally open and normally closed alarm sensors.

 Battery back-up with in-built charger circuit.

 Built-in siren driver.

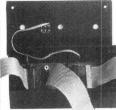
Complete kit including deluxe prepunched metal work and electronics for only...

\$119

LOW BATTERY **VOLTAGE INDICATOR**

Knowing your batteries are about to give up on you could save many an embarrassing situation. This simple low cost project will give your early warning of power failure, and makes a handy beginner's project (ETI 280, March '85)





PARALLEL PRINTER

SWITCH
Tired of plug swapping when ever
you want to change from one printer
to another? This low-cost project
should suit you down to the ground.
It lets you have two Centronics-type
printers connected up permanently,
so that you can select one or the
other at the flick of a switch.
(ETI 666, Feb. 25)

Cat. 46660 \$69.95



STEREO ENHANCER

The best thing about stereo is that it sounds good! The greatest stereo hi-fi system loses its magnificence if the effect is so narrow you can't hear it. This project lets you cheat on being cheated and creates an 'enhanced stereo effect' with a small unit which attaches to you amn unit which attaches to your amp. ETI 1405, ETI, MAR '85)

\$79.50 Cat K54050



MICROREE ENHANCER 1

This brand new, totally amazing expansion unit for the Microbee is a must for all Microbee owners/users/s Most expansion units up to this time offered at best only one or other features, and this made it impossible to run, say, complex sound effects mingled with speech. The Enhancer 1 will do all this and much more as well. It is quite amazing how much has been shoe-horned into this compact unit. The Enhancer 1's many powerful features inlicude:

- Two ATARICOMMODORE

- COLECO/SEARS type joystick inputs. all Microbee owners/users!

- inputs. Two TRS COLOR COMPUTER
- Two TRS COLOR COMPUTER type joystick inputs.
 Allows the connection of Touch Pads, Paddles, Proportional Joysticks, Trakballs, Mice, temperature senors, lights level sensors, transducers, etc, etc!! A 4 voice music/sound effects sythesizer.
 A real time clock.
 Unlimited vocabulary speech synthesizer (option).
 Parallel printer interface (option).
 A built-in speaker with volume control.

- control.
 Listings of all necesary routines for use.
 An impressive demonstration

- An impressive demonstration program package
 Compatible to all Microbees
 All units carry a 90 day warranty and servicing is also available
 Digital recording and playback of speech and sound.
 An 8 channel analog to digital converter with variable voltage or variable resistance type analog inputs and also user selectable resolution from 1 to 9 bits.
 A digital to analog converter with selictable resolution from 1-1 bits.
 Allows automatic data acquisition and logging.
 5 digital input lines. 4 digital out the

- A voice input channel. A voice input channel
 A 40 pin experimenter socket with all 8 analog inputs, 5 digital inputs, 4 digital ouputs, 3.58 MHz buffered clock, sound output (so that you can play the sound effects through your HIFI), 3 high resolution voltage comparators, DAC output etc.

 The amazing Microbe Enhancer is available exclusively from Rod Irving Electronics.

 Cat.

 \$149

\$149

TALKING ELECTRONICS

HEADLIGHT REMIN	
Cat. K80022	\$12.90
IC POCKET RADIO	S
Cat. K80023	\$10.80
LED DICE	
Cat. K80024	\$9.05
LED ZEPLINS	
Cat. K80025	\$7.85
LIGHT THE LED	
Cat. K80026	\$4.60
LOGIC DESIGNED	

(with PC) Cat. K80027 \$20.90 LOGIC PROBES

\$11.55 Cat. K80028 LOGIC DESIGNER \$17.60

Cat. K80029 **LOTTO SELECTORS** \$16.50 Cat K80030

BLACK JACK Cat. K80001 \$11.00 CAPACITANCE METER \$6.25 Cat. K80002 CLOCKS (incl. PCB) \$22.80 Cat. K80003 **CLOCKS** without PCB Cat. K80004 \$19.50 COMBINATION LOCKS \$7.50 Cat. K80005 COUNTER MODULE \$21.70 Cat. K80006

\$11.40 **CUBE PUZZLE** Cat K80008 \$17.90 DIGI CHASER \$17.40 Cat. K80009 DIODE TESTER Cat. K80010 \$3.30

7 SEGMENT DISPLAY

KEN'S DUAL PSU. \$11.80 Cat. K80011 **DUAL TRACKING PSU.** \$18.90 Cat. K80012

8x8 DISPLAY \$22.80 Cat. K80013 DUAL TRACKING PSU.

(without PCB) \$15.60 Cat. K80014 EGG TIMER \$8.30

8W AMPLIFIER \$9.70 Cat K80016

EXPERIMENTER BOARD \$14.30 Cat. K80017 EXPERIMETER DECK \$17.55 Cat. K80018

HANGMAN with PC Cat. K80019 \$12.50 **FM BUGS** Cat K80020 \$6.80

HANGMAN with no PC \$9.20 Cat. K80021 PROGRAMMABLE

COUNTER Cat. K80041 \$11.80 **AUTO RESET**

\$9.70 Cat. K80042 QUICK DRAW \$3.90 Cat. K80043 RAM STACKS \$9.70 Cat. K80044

RELAY DRIVER BOARD Cat. K80045 ROULED

\$8.50 SQUARE WAVE **OSCILLATOR** Cat. K80047 \$4.70

STEREO MINI MIXER Cat K80048 \$23.10 STEREO PRE AMPS \$13.20 Cat. K80049

SIMPLICITY AMPS \$6.80 Cat. K80050 STEREO VU METERS (no PC) Cat. K80051

\$10.70 TRAIN SIGNALS \$7.70 STEREO VU METER

(with PC) Cat. K80053 \$14.00 **TOUCH PUZZLE** \$6.25 TRAIN THROTTLE MK11 Cat K80055 \$4.30 **TREMOLO** \$3.80 Cat. K80056 TEC 1A \$95.00 STAGE-1 KIT

Cat. K80058

\$89.95

SERIES 5000 PRICES SLASHED!

By directly importing and a more technically orientated organisation, ROD IRVING ELECTRONICS can bring you these products at lower prices than their competitors. Enjoy the many other advantages of RIE Series 5000 kits such as "Super Finish" front panels at no extra cost, top quality components supplied throughout. Over

For those who haven't that time and want a quality hi-fi, we also sell the Series 5000 kits Assembled and Tested.



POWER AMPLIFIER

WHY YOU SHOULD BUY A "ROD IRVING ELECTRONICS" SERIES 5000 POWER AMPLIFIER.

- 1% Metal Film resistors are used where possible
- Aluminium case as per the original article.
- All components are top quality.
- Over 1000 of these kits now sold.
- Super Finish front panel supplied at no extra cost.

Please note that the "Superb Quality" Heatsink for the Power Amplifier was designed and developed by ROD IRVING ELECTRONICS and is being supplied to other kit suppliers.

SPECIFICATIONS: 150 W RMS into 4 ohms PPOWER OUTPUT: 100 W RMS into 8 ohms (±55 V SUPPLY)
FREQUENCY RESPONSE: 8 Hz to 20 Hz +0 · 0.4 dB 2.8 Hz to 65
KHz. +0 · 3 dB NOTE: These figures are determined solely by passive filters.
INPUT SENSITIVITY: 1 V RMS for 100 W output.
HUM: 100 dB below full output (flat)

NOISE: 116 Bellow full output (flat.)

NOISE: 116 Bellow full output (flat. 20 KHz bandwidth).

2nd HARMONIC DISTORTION: <0.001% at 1 KHz (0.0007% on Prototypes) at 100 W output using a ±56 V SUPPLY rated at 4A continues <0.003% lot 10 KHz and 100 W.

3rd HARMONIC DISTORTION: <0.0003% for all frequencies less than 10 KHz and all powers below.

TOTAL HARMONIC DISTORTION: Determined by 2nd Harmonic Distortion (see above)
INTERMODULATION DISTORTION: 0.003% at 1.00 W (50 Hz and 7 KHz mixed 4.1). STABILITY: Unconditiona

Cat. K44771.

Assembled and Tested \$499

PREAMPLIFIER THE ADVANTAGES OF BUYING A "ROD IRVING ELECTRONICS"

SERIES 5000 PREAMPLIFIER KIT ARE: 1% Metal Film Resistors are supplied.

14 Metres of Low Capacitance Shielded Cable are supplied (a bit extra in case of mistakes).

English "Lorlin" switches are supplied (no substitutes here).

★ Specially imported black anodised aluminium knobs. Available Assembled and Tested. (We believe that dollar for dollar there is not a commercial unit available that sounds as good.)

SPECIFICATIONS:

FREQUENCY RESPONSE: High-level input: 15 Hz-130 KHz, +0 = 1 dB Low-Level input = conforms to RIAA equalisation: ±0.2 dB DISTORTION: 1 KHz, <0.00%, on all inputs (limit of resolution on measuring equipment due to noise

S/N NOISE: High-Level input, master full, with respect to 300 mV input signal at full output (1.2V) >92 dB Bit N volse: high-level input, master full, with respect to sold not input signal at full output (1.2V) at 5 mV input 50 ohms source resistance connected >86 dB flat |92 dB a-weighted MC input, master full, with respect to full output (1.2V) at 5 mV input 50 ohms source resistance connected >86 dB flat |92 dB a-weighted MC input, master full, with respect to full output (1.2V) and 200 uV input signal >71 dB flat >75 dB A-weighted

Cat. K44791.

Assembled and Tested \$599



THIRD OCTAVE GRAPHIC EQUALIZER SPECIFICATIONS:

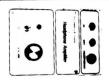
BANDS: 28 Bands from 31.5 Hz to 16 KHz. NOISE: <0.008 mV, sliders at 0, gain at 0 (-102 dB0). 20 KHz BANDWIDTH DISTORTION: 0.007% at 300 mV signal,

sliders at 0, gain at 0; maximum 0.01%, sliders at minimum. FREQUENCY RESPONSE: 12 Hz-105 KHz, +0, -1 dB, all controls 1 Unit... \$199

BOOST AND CUT: 14 dB. 2 Units... \$379 Cat. K44590

POST & PACKING: \$10 per SERIES 5000 KIT.

Rod Irving Electronics!



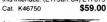
HEADPHONE AMPLIFIER PRACTICE WI

If you play any type of electronic instrument, this headphone amplifier will surely interest you. It will let you practice for hours without upsetting the household,or you can use it to monitor your own instrument in the midst of a rowdy jam session. (EA Feb. 84) 83MA1: \$28.00 Cat. K83011



MICROBEE SERIAL-TO-PARALLEL INTERFACE

PAHALLEL INTERFACE
Most microcomputers worth
owning have an 'R5232' connector,
or port, through which serial
communications (input/output) is
conducted. It is a convention that, for
listing on a printer, the BASIC LLIST
or LPRINT command assumes a
or LPRINT command savenues a
port. Problem is, serial interface
port. Problem is, serial interface
port. Problem is, serial interface
port. Problem is, pred interface
port. Problem port. Problem's, serial interface printers are more expensive than parallel 'Centronics' interface printers . Save money by building this interface. (ETI Jan. 84) ETI 675





LOW OHMS METER

How many times have you cursed your Multimeter when you had to measure a low-value resistance? Well with the "Low Ohms Meter" you can solve those old problems and in fact measure resistance from 100 Ohms down to 0.005 Ohms. (ETI Nov. 31) ETI 158

334.50



PHONE MINDER

Dubbed the Phone Minder, this handy gadget functions as both a bell extender and paging unit, or it can perform either function can perform either function separately. (EA Feb. 84) 84TP2





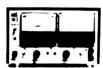
SOUND SIMULATOR FOR MODEL TRAINS

Fancy a diesel sound simulator for your model train layout? This circuit mounts inside the train for added realism and even varies its 'speed' according to the throttle setting. (EA Nov.'84)
Cat. K84110 \$18.0 \$18.00



DIRECTIONAL DOOR

DIRECTIONAL DOUR
MINDER
Most electronic door minders
function by having a beam of light
shinning across doorway
interrupted, but are incapable of
detecting whether the light beam is
broken by a person entering or
leaving the room. this project
overcomes that problem with the aid
of digital logic.
(ETI Nov. 84) ETI 278
Cat. K42780
\$29.95



LAB SUPPLY

LAB SUPPLY
Fully variable 0-40V current limited
0-5A supply with both voltage and
corrent metering (two ranges:
0-0-5A0-5A). This employs a
conventional series-pass regulator,
of a switchmode type with its
attendant problems, but dissipation
is reduced by unique relay switching
system switching between laps on
the transformer secondary. the transformer secon (ETI May'83) ETI 163 Cat. K41630 \$175.00



CAR IGNITION KILLER

CAN IGNITION KILLEH
Most car burgular alarms are easily
circumvented, but not this cunning
"Ignition Killei". This sneaky
antitheft device uses a 555 timer to
place an intermittent short circuit
across the points. Until disabled by
its hidden switch the circuit
effectively makes the car
undriveable — a sure deterent to
thieves! (EA Feb. 84) 84AU1

\$16.95 Cat. K84010 (Our kit includes the box!)



ELECTRIC FENCE

Mains or battery powered, this electric fence controller is both inexpensive and versatile. Based on an automative igintion coil, it an automative gintion con, it should prove an adequeate deterrent to all manner of livestock. Additonally, its operation comforms to the relevant clauses of Australian Stnd 3129. (EA Sept. 82) 82EF9 \$19.50 Cat. K82092



50V 5A LABORATORY POWER SUPPLY

New switchmode supply can deliver anywhere from three to 50V DC and currents of 5A at 35V or lower. riigniy efficient design. (Ea May,June'83) 83PS5 Cat. K83050 \$149



RADIOTELETYPE **CONVERTER FOR THE**

MICHOBEE
Have your computer print the latest news from the international shortwave news service. Just hook up this project between your short wave receivers audio output and the MicroBee parallel port. A smiple bit of software does the decoding. Can be hooked up to other. be hooked up to other outers too. (ETI Apr. 83) \$20.00



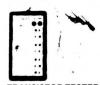
ELECTRIC DUMMY LOAD

With this unit you can test power supplies at currents up to 15 Amps and voltage up to 60 Volts. It can "sink" up to 200 Watts on a static test and you can modulate the load to perform dynamic tests. (ETI Oct. 80) ETI 147 Cat. K41470



VIDEO AMPLIFIER

Bothered by smeary colours, signal beats and RF interference on your computer display? Throw away that cheap and nasty RF modulator and use a direct video connection instead, it's much better! The Video Amplifier features adjustable gain and provides both normal and inverted outputs. Power is derived from a 12V DC plugback supply. (EA Aug.'83) 83VA8 Cat. K83081 \$15.00



TRANSISTOR TESTER

1000's SOLD Have you ever desoldered a suspect transistor, only to find that it checks OK? Trouble-shooting exercises are often hindered by this type of false alarm, but many of them could be avoided with an "in-circuit" component tester, such as the EA Handy Tester, (EA Sept. 83) 83TT8 Cat. K83080 \$15.00



FUNCTION GENERATOR

FUNCTION GENERATOR
This Function Generator with digital
readout produces Sine, Triangle
and Square waves over a frequency
range from below 20Hz to above
160Hz with low distortion and good
envelope stability. It has an inbuilt
four-digit frequency counter for ease
and accuracy of frequency setting.
(EA pril 82.820A3AB)
Cat K82040
Cat K82040
S87.50 \$87.50

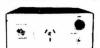


Can measure temperature from -50-to 150-c. It simply plugs into your multimeter - great for digital multimeters. Accuracy of 0.1-c resolution of 0.1% (ETI June 83) ETI 153 Cat. K41530 \$24.50



150W BASS AMP

This guitar amp for impeccable bass players features many facilities found on expensive 'commercial' ones. It delivers 150 watts into 4ohms, has a t-band graphic limiter, line out and bi-amp facilities. (ETI Aug. 84) ETI 1410 Cat. K54100 \$298 \$299



40 W INVERTER 40 W INVEHTER
This 12 240 V inverter can be used
to power up mains appliances rated
up to 40 W, or to vary the speed of a
turntable. As a bonus, it will also
work backwards as a trickle charger
to top up the battery when the power
is on. (EA May 82) 82IVS
CAL K82050
\$49.50 \$49 50



ZENER TESTER

A simple low cost add-on for your multimeter. This checks zeners and reads out the zener voltage directly on your multimeter. It can also check LEDs and ordinary diodes. (ETI May 83) ETI 164
Cat. K41640

\$9.50



COMPUTER DRIVEN RADIO-TELETYPE TRANSCEIVER

TRANSCEIVER
Here's what you've been asking for, a full trasmit-receive system for computer driven radio teletype station. The software provides all the latest "whizz-bangs" like split-screen operation, automatically repeating test message, printer output and more. The hardware uses tried and proven techniques. While designed to team with the popular Microrbee, tips are available on interfacing the unit to other computers. other computers. (ETI Nov.'84) ETI 755 Cat. K47550 \$139.00



INTERCOM

OVER 300 SOLD!

Motorcycling is fun, but the conversation between rider and passenger is usually just not possible. But build this intercom and possible. But build this intercom and you can converse with your passenger at any time while you are on the move. There are no "push-to-talk" buttons, adjustable volume and it's easy to build! (EA Feb. 84) 84MC2 Cat. K804020 \$45.00



EPROM PROGRAMMER

No need for a Micro with EA's great Eprom Programmer suitable for 2716/2758 Eproms. (EA Jan. 82) 82EP1

Cat. K82013 With Textool Sockets \$59.95



EFFECTS UNIT

An "effects unit" that can create phasing, flanging, echo, reverb and ato effects. June.'83) 83GA6 K83060 \$75.00



EA AM STEREO

AM stereo is now broadcast in Australia on an experimental basis This add-on decoder works with the Motorola C-QUAM system. (EA Oct. 84) 84MS10 Cat. K84101 \$24 QF



MUSICOLOR IV

MUSICOLOR IV
Add excitement to paries, card
nights and discos with EAs
Musicolor IV light show. This is the
latest in the famous line of
musicolors and it offers features
such as four channel light chaser, front
panel LED display, internal
microphone, single sensitivity
control plus opto-coupled switching
for increased safety. for increased safety. (EA Aug. 81) 81MC8 Cat. K81080 \$89.00



ELECTRONIC

MOUSETRAP This clever electronic mousetrap disposes of mice instantly and mercifully, without fail, and resets itself automatically. They'll never get away with the cheese again! (ETI Aug. 84) ETI 1524 Cat. K55240 \$29.95



PH METER KIT

PH METER KIT
Build this pH meter for the swimming pool season is here again! From swimming pools to fish tranks to gardening, this pH meter has many applications around the home. This unit features a large 3 ½ digit liquid crystal display and resolution to 01 pH units, making it suitable for use in the laboratory as well. use in the laboratory as well (EA Dec. 82) 82PH12 Cat. K82123



DUAL TRACKING POWER SUPPLY

POWER SUPPLY
Built around positive and negative 3Terminal Regulators, this versatile
dual tracking Power Supply can
provide voltages up to 2A. In
addition the Supply features a fixed
+5V 0 9A output and is completely
protected against short circuits,
overloads and thermal runaway.

(EA March 82) 82PS2
Cat. K82030
\$87.50



VIDEO ENHANCER

100's SOLD Like tone controls in a hi-fi amplifier, touch up the signal with this Video Enhancer. (EA Oct. 83) 83VE10 \$35.00



30 V/1 A FULLY **PROTECTED POWER**

SUPPLY
The last power supply we did was
the phenomenally popular ETI-131.
This low cost supply features full
protection, output variation from 0V
to 30V and selectable current limit.
Both voltatage and current metering
is provided. (ETI Dec. 83) ETI 162 \$52.50



MOSFET POWER

MOSFET POWEH
AMPLIFIER
Employing Hitachi Mosfets, this
power amplifier features a 'no
compromise' design, and is rated to
deliver 150 W FMS maximum
and features extremely low
harmonic, transient and
intermodulation distortion.
(ETI Jan. 81) ETI 477
Cat. K44770
S69.50

Remember....We have over 260 Kits, most of which are in stock!!



16-18yrs Shop Assistant(s)

If you're an electronics enthusiast and would like to work in electronics retail, we'd like to hear from you.

Phone: Greg Boot (03) 663 6580



ROD IRVING ELECTRONICS 425 High Street, NORTHCOTE, 3070 VICTORIA, AUSTRALIA Phone (03) 489 8866 TELEX: AA 38897 48-50 A'Beckett Street, **MELBOURNE**, 3000 VICTORIA, AUSTRALIA Ph. (03) 663 6151 Mail Order and correspondance: P.O. BOX 235 **NORTHCOTE 3070**

> MAIL ORDER HOT LINE



(03) 481 1436

POSTAGE RATES \$1-\$9.99 \$2.00 \$10-\$24.99 ... \$3.00 \$25-\$49.99 ... \$4.00 \$50-\$99.99 ... \$5.00 \$100-199 \$7.50 \$200-\$499 \$10.00 \$500 plus \$12.50 This is for basic postage

only, Comet Road freight,

bulky and fragile items



will be charged at



VISA

ENERGY SAVERFor car air-conditioning

Eric Eulenstein

One of the greatest creature comforts that can be installed in a car for summer motoring is the air-conditioner. The problem is that they use vast amounts of power. This idea shows how power consumption can be reduced to acceptable enough levels to install air-conditioning for next summer.

LIKE MOST refrigeration equipment an air-conditioner depends on the latent heat of a refrigerant. The air is used to heat and vaporize the liquid refrigerant in the evaporator and it's cooled in the process. The heated refrigerant is then compressed, a lot more heat being generated in the process, and then passed on to the condenser where it must be cooled substantially before it can reliquify.

Considering that the interior of the car has large amounts of heat entering it via the bodywork, the windows and the engine compartment, it's obvious that the refrigeration plant has an arduous job — far more so than the average home refrigerator. Human bodies also add substantially to the heating problem in such a confined space.

Consider now the electrical system of the unit in question. The high volume fan in the evaporator requires up to six amps to drive it, and the magnetic clutch on the compressor requires about four amps. The condenser fan needs about ten amps to operate.

Hence, when actually operating, the air conditioner load is about twenty amperes.

I discovered these facts after I noticed that the air conditioner cutting in to do a cooling cycle caused the headlights to dim noticeably. The question was: what could I do about it?

On a hot day the condenser needs a large volume of air passing through it. But when on the open road (or, say, above 60 kph) the speed of the car itself forces enough air through the condenser. Under these circumstances the fan is quite unnecessary.

But how to control it? Many electronic means are obvious, but not warranted because of complexity. There is one source of control that will always be available and proportional to need, and that is the wind itself!

With experimentation a wind-controlled flap was designed with a small mercury switch on it that operated the fan relay when the car was stopped or slow moving, but at about 60 kph it reaches the end of its

travel (through about 30 degrees), tilting the mercury switch sufficiently to switch off the fan. A spring in tension across the flap's pivot point causes a small snap action to occur on the flap to prevent midway flutter of the switch.

In the interests of reliability and easy maintenance I transferred the heavy current loads from the evaporator thermostat contacts to relays, i.e. the thermostat now operates a relay, which in turn operates the compressor clutch and the condenser fan relay. The condenser fan relay is then under control of the mercury switch on the wind flap.

The relays used were the small 30 ampere capacity plug-in types with interlocking socket bases now commonly used in automotive electrics. They were mounted together in a row on a length of flat strip at the front of the engine compartment with others that I had installed to control headlights, driving spotlight, and horn. Thus if any relay unit is doubtful in operation it can be replaced very quickly, or various sections of the system can be isolated by relay removal to make fault finding easy.

Also to further improve relay contact life, diodes were connected across the highly inductive circuits such as the clutch and fan to prevent destructive arcing at the relay contacts. Whether this is a significant factor for reliability is probably questionable, but



the infallible electrical operation of the system for seven years seems to indicate that these measures were not entirely superfluous.

The unit I made up used four sheet steel pieces. Dimensions are not critical, and ingenuity (and experimentation) are the order of the day!

The flap is made from a piece of 1.4 mm sheet steel cut into a square about 100 mm across. You must leave two tabs at one end for the flap to hinge around, so they will have to be bent up at 90 degrees.

These tabs must have a hole big enough to take a piece of iron wire or brass rod of about 1/8-inch diameter. This is carried by the flap yoke. This is a strip with ends bent up to carry the brass rod, and mounting holes to allow attachment of the unit to the car.

It is a good idea to burr the ends of the rod to prevent it coming out. Another good idea is to put brass washers between the yoke and the flap to make sure the two pieces move freely.

The mercury switch is carried on its own metal strip. The one I constructed was bent into a U shape to enclose the switch and then pop-riveted onto the flap so that the switch was oriented at 90 degrees to the flap. The bulb and its leads are insulated from the metal parts by a bit of veroboard stuck on with Silastic.

I used a fourth piece of metal for a flap limiter, to prevent the flap from travelling too far and wiggling around in the slip-stream. Doubtless with a bit of ingenuity in either cutting the metal or in location this could be omitted.

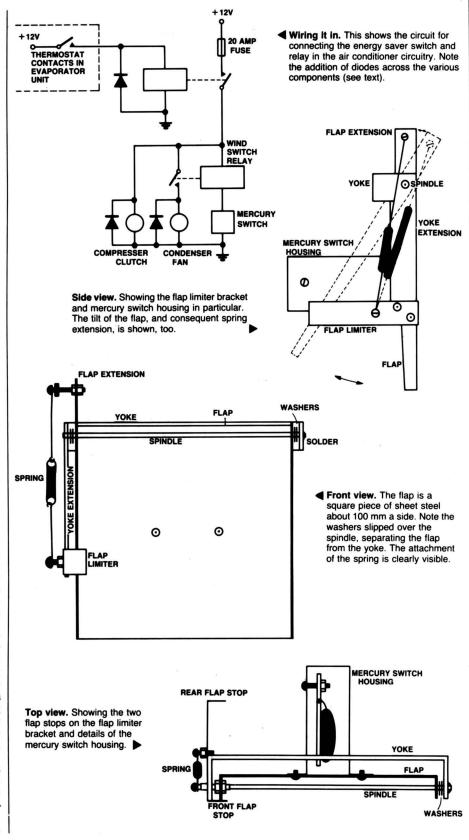
A small spring placed between the flap and one of the non-moving parts, and running across the axis of the hinge, provides the system with some hysteresis, by attemping to hold the flap open or closed a little longer than the air pressure would allow.

The wind switch should be mounted high in front of the radiator behind the grille so that the flap hinge is about level with the top of the grille opening. Thus it is in direct path of the wind coming through the radiator grille but not entirely open to the weather.

To be sure that it does work, wire a meter or a lamp from the wind switch into the car so that its operation can be observed. If all is well the switch will operate at about 50 kph and a slight hysteresis will be noticed, ie it will switch at plus or minus a few kph depending on whether accelerating or decelerating. If the hysteresis is more than, say, 5 kph, the chances are that the spring tension on the flap is a bit much and a small adjustment is required.

When you are satisfied that the switch is working OK, it can be wired in as per the diagram, and from then on, you may be sure of efficient operation from your airconditioner for summer driving!

Happy motoring!



Ausgraph computer art contest

A computer art contest, open to users of all types of computer graphics equipment from turnkey systems to microcomputers, is being held in conjunction with this year's Ausgraph '85 conference.

Ausgraph '85, Australia's only specialist conference and exhibition on computer graphics, is being held in Brisbane on August 12-16, 1985. It is organized by the Australasian Computer Graphics Association.

Computer art is a rapidly growing field in Australia, with machines, such as the Apple Macintosh, providing excellent artistic capabilities at an affordable price. In Europe and

America, the art is reaching a high degree of sophistication, with artists producing work of amazing realism.

The first Ausgraph computer art contest is being held to encourage artists and others in the field to publicize their work, and to further the development of computer art in this country.

Works submitted may be on printout or recorded on photographic media, and should be accompanied by the entrant's name, address and a statement of the equipment used. The type of equipment will be taken into account by the judges, who will place emphasis on the originality and expression of the overall composition rather than the special effects created by the hardware.

The winning entrant will receive an expenses-paid trip to this year's Ausgraph conference, although Brisbane entrants may opt for a trip to Ausgraph '86 in Sydney. Other prizes will be awarded at the discretion of the Ausgraph committee, including a \$200 voucher for the best school student entry.

For further information contact the Conference Secretariat, Ausgraph '85, PO Box 29, Parkville, Vic 3052. (03)387-9955.

Personally secure computers

Forget copyright, what about the pilfering of business information with all the nightmare of industrial espionage!

Data security has certainly been a problem in business due to the ease of copying diskettes that could contain *any* confidential information.

However Eracom Queensland has introduced its new PC Encryptor. The new product consists of an electronic module or 'card' to secure data stored in IBM (or compatible) PCs by activating a set of security installation programs once the card is in place in the computer. The Encryptor can scramble information contained on diskettes as well as fixed disks. A "key" or sequence of binary numbers identifies each individual scambling activity. It also labels and protects an individual PC and extends to personal keys for each person using that PC to protect his or her particular data.

For further information contact Eracom, 26 Greg Chappel Dve, Burleigh Heads, Qld 4220. (075)56-0911.



Nashua converts computer software

The computer explosion has spawned a multitude of operating systems — all of which work well but cannot talk to one another.

However, the recentlyreleased Australian-designed and manufactured Nashua Data Converter changes that.

This disk-to-disk conversion system emulates the file systems of many of the major computer operating systems including CP/M, CP/M86, PC-DOS, MS-DOS and UNIX.

For example, data files from an NEC APC running on CP/M86 using 8-inch diskettes can be converted to an IBM-PC using MS-DOS and a 5¼-inch diskette — as a direct transfer without altering the data.

"The Data Converter provides high speed, simultaneous diskette to diskette copies with full verification through the use of specifically written emulation programs. This ensures the destination copy will provide the total reliability that is critical in the distribution of software throughout the user market-place," said a Nashua representative.

For further information contact Nashua, PO Box 309, Artarmon, NSW 2064. (02)958-2044.

CLUB CALL

The **Melbourne Super-80 Users Group** advises that its main group meets at the Heathmont Uniting Church Hall, Canterbury Rd, Heathmont at 7.30 pm on the second Friday of each month; the north-western subgroup at the Broadmeadows High School, Cnr Belfast and Blair Sts, in Room 35 South Wing, at 7.30 pm, fourth Friday each month; the south-eastern sub-group at the Saint Elizabeth School Library, 111 Bakers Road, Dandenong North at 8 pm, first Tuesday of each month.

Artificial intelligence gets closer

Texas Instruments' new Personal Consultant development system enables developers to design programs to help solve problems, by using some of the same techniques used by human experts.

Applications developed with the Personal Consultant package have the capacity to handle uncertain or imprecise data. The use of certainty factors allows the system to determine the state and degree of confidence for a particular conclusion. The TI Personal Consultant system can also explain its line of reasoning; the user can ask why a particular question was asked or how the system reached its conclusions. This allows the user to accept, or have a basis for rejecting the system's recommendations.

Its development tools can be used to prototype and develop applications in diverse areas such as tax and investment counselling, loan analysis and approval, automative problem diagnosis, and insurance policy and rate selection.

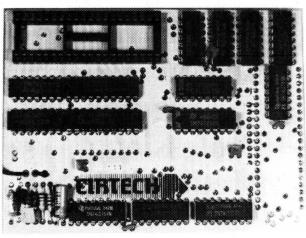
According to TI Personal Consultant expert systems can co-exist with the MS-DOS compatible business and scientific software products available for the TI desktop and portable professional computers.

The software allows up to 400 production rules on the TI Professional Computer, which specify the actions or steps taken by a program in a particular situation.

TI will be offering the Personal Consultant development package through a specialized direct-sales channel aimed primarily at universities, research organizations, large corporations with internal AI training and development needs, and independent commercial software developers.

For further information contact TI on (02)887-1122.

BRIEFS



Apple IIc CP/M module

Thinking Systems has announced the national release of its Apple IIc CP/M Module. The dealer-installed CP/M Module fits completely inside the case of the IIc, allowing it to run all standard Apple CP/M software with no modifications, up to 30% faster than most CP/M cards. The module does not affect the normal operation of a IIc as it is only activated when you "boot" a CP/M disk. It operates by "slaving" the Apple to a Z80 microprocessor, thus allowing the direct execution of Z80 or 8080 code. It is also fully compatible with CP/M version 2.23.

Microsoft Cobol

Microsoft has announced the release of Microsoft Cobol (Version 2.0) making it possible for microcomputers to be used in the development of Cobol applications for mainframe computers, and for mainframe computer Cobol applications to be moved to microcomputers. Features of the package include four types of files: sequential, line-sequential, relative, and B+ tree indexed sequential (ISAM); an ISAM file-recovery utility (Rebuild); advanced interactive screen capabilities; file-sharing for multi-user environments; dynamic CALL and CHAIN; and an INSTALL routine, allowing applications to be developed on one type of hardware and run on another.

Graphics Partner for Lotus 1-2-3

A new program distributed by Co-resident Software of Neutral Bay, Sydney, enables a Lotus 1-2-3 user to add symbols, text, special founts to a graph without exting Lotus itself. The program is co-resident in memory, having been loaded first. It also has the facility to print the graph without using the normal disk swapping routines. Once the graph is on the screen, pressing a reserved combination of keys activates the Graphics Partner. It is then possible to toggle between the graph and the Graphics Partner menu which has many options such as spainting, filling in, drawing circles, loading special founts and symbols, zooming, printing and saving. It is even possible for a graph to be overlaid by another. For further information contact Co-resident Software, 99 Military Rd, Neutral Bay, 2089 NSW. (02)908-2355.

Commodore management

Introducing the Commodore 'Manager', to help organize your cheque book, stamp collection, football team, cricket club or community organisation, investments, Christmas card list, or recipes! An electronic filing cabinet, the Manager does sorting and reorganizing at computer speed with little or no operator intervention.

special opportunity for our readers to save at least 20% on the regular price of Professional Magnetic Media disks by



Plastic library case included in purchase price

Could you ever place a value on the information you store on your computer disks . . . let alone the time it took to put it there? With so much at stake, don't settle for anything less than the very best disks available — **Nashua Professional Magnetic Media.**

What is the Nashua difference? Simply this: their disks are strictly monitored during every stage of production. They **don't** rely solely on an inspection of the finished product to detect flaws. Nashua build their product right **in the first place.** If a disk doesn't stay within narrowly defined quality margins . . . well, it's just not good enough to carry the Nashua name!

Nashua disks offer you quality with **unequalled** consistency. And by special arrangement, we proudly offer our readers an opportunity to save on this superb product.

We are dealing directly with Nashua on your behalf . . . so their superb Professional Magnetic Media disks are available to you at prices at least 20% (more, for some of the varieties shown) below recommended retail. Don't miss this opportunity!

Complete and send your order form today!

We regret that disks can be sold in boxes of ten ONLY. Smaller quantities cannot be supplied.

CODE	DESCRIPTION	PRICE per box
MD1	51/4" single sided single density	\$30.00
MD1D	51/4" single sided double density	\$33.00
MD2D	51/4" double sided double density	\$43.20
MD2F	51/4" double sided 96 tracks per inch	\$49.80
FD1	8" single sided single density	\$45.00
FD1D	8" single sided double density	\$51.00
FD2D	8" double sided double density	\$52.80

FEDERAL WARKETING MAIL			
Nashua Floppy Disk Offer	Send complete Marketing. PO	ed coupon t Box 227 W	o: Federal aterioo NSW 2017.
Name	CODE	QUANTITY	PRICE
Address			
Postcode			
Signature			
American Express ☐ Bankcard ☐ Cheque* ☐			
 Please make cheques payable to the Federal Publishing Company Pty Ltd 	,		
Credit Card No:	Plus \$2	.50 postage 8	L
			(
Card Expiry Date: Allow four weeks for delivery		TOTA	L

New 10 megabyte hard disk system makes microbee's 128K Small Business Computer a complete management tool for serious business, scientific and educational applications.





128K SBC single 400K Disk Drive with 10 Megabyte Hard Disk, Monitor and Bundled Software*

\$2995 incl. Tax

128K SBC with dual 400K Disk Drives, Amber Monitor,
Bundled Software* and DP100 Dot Matrix Printer \$2395 incl. Tax
(OR DSY120 Daisy Wheel Printer FOR THE SAME PRICE!)

128K SBC with dual 400K Disk Drives, Green Monitor and Bundled Software*

\$1995 incl. Tax

*WORDSTAR/MAILMERGE 3.3 MICROSOFT BASIC AND MULTIPLAN MW BASIC TELCOM COMMUNICATIONS SUPPORT UTILITIES AND MANUALS.

mcrobee Complete Designed and manufactured in Australia by

PHONE ORDERS CONHECORD ACCEPTED

microbee technology centres

N.S.W.

1 Pattison Ave, Waitara 2077 Phone (02) 487 2711

VIC.

729 Glenferrie Rd, Hawthorn 3122 Phone (03) 819 5288

W.A.

141 Stirling Highway, Nedlands Phone (09) 386 8289 S.A.

151 Unley Rd, Unley 5061, Phone (08) 272 1384

OLD

455 Logan Rd, Stones Corner, 4120 Phone (07) 394 3688

FACTORY

Koala Crescent, West Gosford 2250 Phone (043) 24 2711

ETI June 1985 — 101

WRISTWATCH COMPUTER — the Seiko TUC-2000

The shape of things to come? The central component of this new computer system is a 'wristwatch' which contains a 4-bit microprocessor along with 2K of RAM. It's ultra-portable and smart, but needs more software work to reach full potential.

Jonathan B. Scott

THE TUC-2000 computer seems a touch large on my wrist, but then I am used to a small quartz watch only 6 mm thick, with a white face, hands and Roman numerals. The Seiko is 12 mm thick, 40 mm high and 35 mm wide. Nevertheless, it is the smallest thinking box I have seen.

There are four components available in the series at the moment: the Wrist Module (TUC-2000); the Controller (TUC-2200); a separate Keyboard (TUC-2100); and a ROM Pack which plugs into the controller. The controller provides all the functions of the separate keyboard unit in a larger machine. (It is 3 x 20 x 14 cm, and designed to rest on a desk or be carried in a briefcase.) For this reason I have excluded the keyboard in this review. The only ROM available at the moment is a games ROM which is supplied with the controller.

The controller contains 4K of RAM and 26K of ROM, which expands to 34K when a ROM pack is plugged into it. It also contains a small (20 character) dot matrix thermal printer, a rubber-key QWERTY keyboard, and a flip-up support which is the communication device to connect to the watch module. The watch module itself provides the display, which completes all the requirements for a small computer. Three penlight (AA) cells are expected to give some 300 hours of operation. An ac adapter can also be used, although there is no information indicating what voltage it requires except by implication from the batteries used. Further, the manual has a correction which informs the buyer that the ac adapter is not yet supplied outside America!

The wrist module, as described above, contains 7.5K of ROM (1.5K of character generator) and 2K of RAM. The LCD display has 4 lines of 10 characters, each character being a 7 x 5 dot matrix. Sufficient

alphanumeric and graphics characters are included to allow formation of single, double and quadruple sized numbers, and single and quadruple sized letters and special symbols. The special symbols include aeroplane and telephone ideographs etc, for making concise reminder messages. It also contains the circuitry for non-contact communication with the controller. The front face (it cannot really be called a front panel) is equipped with four press buttons in a row. The wristband is standard.

Like all good inquisitive electronics enthusiasts we opened up the watch module to see what was inside. The single LSI IC is bonded to the pc board and covered with a sealing compound, much like a common digital watch. The battery is a lithium button cell. It is almost the size of my other wristwatch by itself. This accounts for the prediction of 1.5 years of operating life, despite the fact that the watch must transmit to, as well as receive from, the controller. The communication rate is 2K baud, and it is effected by magnetic induction. There is a 3 cm diameter coil in the watch, which forms one half of a transformer (with the counterpart coil in the controller) for data loading and dumping operations. The construction practices are very standard for digital wristwatches.

Operation

The first step in operation is to 'connect' the controller to the watch. This is done by flipping the rest on the controller up, and placing the watch on the rest. Pressing the 'transmit' button on the watch brings about the message "TRANSMIT STAND-BY". Next, turn on the controller and select the operating mode. There are five modes to choose from: Memo A, Memo B, Applications, Basic and Calculator.

Memo modes

The memo mode of the wrist module divides the available RAM up into two areas of 1000 bytes each. These are labelled Memo A and Memo B. When either memo mode is selected on the controller, the watch is programmed for memo operation, and it becomes possible to load the watch with the 1000 bytes of information attached to that memo area. When working with memo A, it is not only possible to enter text into the watch and print it back out onto the printer, but also to back up the memo to the controller or reload a backup to the watch. With Memo B, the backup facility is not available, because RAM is not reserved for that function inside the controller.

The choice of what to do is made menu style. The 'stop' key is the key used to escape to a higher menu level at any time. When in Memo B the menu is only two entries long, offering editing or printing out of the memo. In Memo A, backing up, reloading and a combined backup/print are also offered, giving a five entry menu.

Although the controller's ten function keys are defined for editing (they are never user definable), the editing of the memo space can be quite tedious. For instance, it is not possible to insert a single character early in the memo. Only whole lines can be inserted; this makes correcting minor errors very space wasteful or very tedious. Another way of describing this is that in the memo text area there is no automatic word wrap from one line to another; the only way of eliminating a character is to space over it. This unnecessary crudity could become very annoving after a little while.

When stored in the watch, and with the watch free of the controller, the memo can be viewed using the buttons on the watch. These permit the 100 lines of 10 characters



in each memo to be viewed, though not modified. In effect, the wearer is carrying around 2000 characters of information. This might be phone numbers for example. Because of the formatting constraints this information would be typed in with one line assigned to a name and the next to the number, in order to keep the display sensible. Thus Memo A could hold some 50 names and their associated telephone numbers. Looking through the small book which is crammed in my wallet I find 59 names, some with 2 numbers, but only half of which I probably need with me, so the memory would seem quite adequate for small business use. A further observation: if the data is in a list, such as numbers and names, the line-only editing facilities are most adequate. The neat convenience of this suggests that this is precisely what the original programmer had in mind.

Calculator mode

In the calculator mode the controller operates purely as a four function calculator, with the watch acting as the display. It is a cleverly written routine, as the watch face sets out the problem as one would if doing it longhand:

Multiplicand x Multiplier

Product

Remind you of your schooldays? It looks nice. However, the calculator mode has two very sad omissions. Firstly, there is no way of using the printer at the same time. For accounting functions a printout is very desirable. Secondly, the calculator is four function only. No square roots, no scientific functions. This is very silly, as the routines for doing all that sort of calculation are in-

cluded inside the machine as part of the Basic interpreter ROM. It surely would not have been too hard to incorporate some of those functions that we have come to expect of every calculator costing more than \$10 or so?

Of course, you can execute those sorts of calculations in Basic, as will be seen shortly. You could even write a Basic program that does just what this calculator routine is doing and then include the extra functions that you want. (The Basic is a stripped down version, which would make it tricky, as reading the keyboard for single keystrokes is not supported.) Nevertheless, it cannot help but be noticed that the Seiko man writing the calculator routine was not talking to the rest of the design team effectively — notably the Basic and printer engineers. The result is the beginnings of an elegant facility which is left far short of its potential.

Basic

The Basic mode is 1983 vintage Microsoft, which is pleasing to see. As Basic uses the memory into which Memo A is backed up, the backup must be discarded (not affecting the watch copy of the memo) when entering. In normal mode of operation this gives 1561 bytes free for user use. There is a 'high level' mode, which makes 2922 bytes free, but use of this level means that use of the other funtions of the controller, such as memo mode, would destroy the Basic program in memory. It is thus better to make do with the lower limit if possible, so that your memos can be updated and applications run, without losing the Basic program.

The Basic is 8K, and so does not offer much of what the bigger Microsoft Basics do. It is sensibly stripped down, though. It has a command for printing out of Basic

into the Memo B area in the watch, so that you can carry away the results of your sales analysis on your wrist. The editing facility is good (much better than the memo editing!). Multi-dimension arrays are supported, for what that is worth with less than 3K maximum available. Functions may be defined within a program, (DEF FN), but they may not be linked to the 'special' function keys of the keyboard. This is the only machine that I have ever seen which provides *numbered* function keys but does not support them with user definability from within the machine!

The following list of the included commands shows what can be done and what cannot:

Command/Statement	Intrinsic Function
BEEP	ABS
CLEAR	AND
CLS	ASC
CONT	ATN
DATA	CHR\$
DEF FN	COS
DIM	CSRLIN
EDIT	EXP
END	FRE
FOR~NEXT	INT
GOSUB~RETURN	LEFT\$
GOTO	LEN
IF~THEN,IF~GOTO	LOG
INPUT	MID\$
LET	NOT
LIST	OR
LLIST	POS
LOCATE	RIGHT\$
LPRINT	RND
MPRINT	SGN
NEW	SIN
ON~GOSUB,ON~GOTO	SPC
PRINT	SQR
READ	STR\$
REM	TAB
RESTORE	TAN
RUN	VAL
STOP	•

COMPUTING REVIEW

The important observation that readers familiar with Basic will probably have made by now is that there are no mass storage commands in the list. Unfortunately, this machine does not even allow storage of programs on tape. This is rather disappointing, more so if you have ever had to type in an old 2K long program. So every time you want to do your sales analysis and pump the results out into your watch Memo B area, you get to type the program in first. What you saved on the out, you had to spend on the in! Seiko will have to provide some mass storage facility if they want this machine to go anywhere as a Basic machine.

Application mode

Entering application mode effectively tells the controller to look at the application ROM pack. It responds by presenting the menu, with one entry for each application program found in the 8K of ROM, plus the two intrinsic applications. One of these is the DEMO program, which is basically included for showing off, such as in a shop display. The other is the 'SCHEDULE' program, which will be discussed shortly.

Application programs, with the exception of the DEMO program, seem to be designed to be loaded from the ROM into the wristwatch. (That is to say, there is no mention of ROMs being available for other functions, such as expansion of the Basic to include mass storage, etc.) When a selection is made from the application menu, the corresponding program is loaded into the 2K of RAM in the wristwatch. The ROM pack supplied contains four games which may be played on the wristwatch, once loaded into it.

Neither SCHEDULE nor any of the games from the ROM pack can co-exist in the watch with any memos. Therefore you have to back up Memo A and lose Memo B to get any of the other functions.

The SCHEDULE program allows the watch to contain 20 characters associated with each date for the next month. Thus, instead of scrolling through a memo space,

you have things stored by day, so that you can look up what you are doing on this day or that. There is thus about 620 bytes of data stored, and the rest is program. If this program used the timekeeping facilities of the watch and gave some alarm or daily display of tasks, it would be excellent. Unfortunately, it does not; it is purely data stored in a filing system based on date. At each increment of the date, the program erases that day's message, making the memory available for the day one month ahead. It even does this if the information has not been viewed.

With the clock functions inside the watch, and the large amount of memory, it should have been possible to create a 'SCHED-ULE' program which effectively allowed the setting of alarms up to a month ahead, with an alphanumeric label attached to each alarm. Any readers familiar with the operation of the brilliant HP41 Time module will appreciate just how neat and handy such a facility could be on the wrist, instead of in the briefcase. I was most disappointed to see how crude the scheduling program turned out to be.

The games supplied were very amusing, but of course rather limited by the hardware. There are real-time (arcade type) ones, as well as thinking ones. Suffice to say that they are very handy for use on trains and buses to provide some diversion.

Documentation

The controller and watch are supplied with two books, one covering the controller, watch and ROM modes and functions, the other giving a description of the BASIC and a beginners' startup guide to programming. Both of these books are set out just like a set of instructions for using a plain watch, not surprisingly. On the whole the text is readable. I have seen 'instruction' books which were totally undecipherable. This is not at all like that, and provides a neat and complete description of all the facilities available. It tends to be aimed at the sort of person who is practised at reading

10-2 WEDNESDE 10:0842

concise descriptions, but I observed nontechnical friends had no difficulty. Most have had to learn how to drive their newfangled digital wristwatches, so they were acquainted with the basic style. The Basic book may be inadequate for anyone who has never programmed before, but I have not put this to the test.

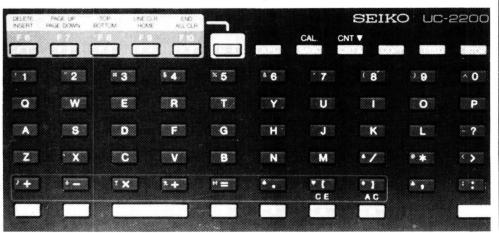
Comments and Conclusions

Apart from the shortcomings already mentioned, there is one inadequacy in the controller which will be felt by any computer minded enthusiast: there is no provision for user-written software to be loaded into the wristwatch. This means that the great possibilities afforded by 2K of RAM on your wrist cannot be exploited except via the software provided complete by Seiko. As we have already seen, this is rather sparse and unimaginative.

It would not be possible to transfer a Basic program to the watch and have it run, simply because the Basic ROMs are in the controller so the program could not be interpreted. It would be necessary to provide an assembler or similar in a ROM pack.

However, with some simple language or an assembler, a user could write whatever he wanted. I, for instance, would write a program that acted like the watch but with many alarms, all set up to a month or so in advance, and with reminder messages attached to each one. Thus when I make an appointment on Friday for lunch next Tuesday with Tim Brown, to which I must take a certain contract, I enter it with a message. Then next Tuesday at 11.30 when I am in a meeting which has run on, and have forgotten the date, my watch beeps to warn me that I must leave soon, and that I need that contract.

In summary, the TUC-2000 series is a potentially excellent lot of hardware, but has not had its operating system and applications programs as well thought out as it might have. It is already very useful, and it is a gadget of the most avant-garde and eye catching type to boot. If Seiko has some success with the product, they are certain to clean up their software act and issue more useful things in ROM packs. However, whether or not the *current* facilities are worth the few hundreds of dollars required to purchase it is another matter.



THE MASTER-CARD SYSTEM SOLUTION

THE MASTER-CARD — FEATURES

THE MASTER-CARD is a fully tested and proven Single Board Computer that provides all the necessary requirements for a complete computing system.

complete computing system.

THE MASTER-CARD features a 4 Mhz
Z80A CPU running CP/M Plus Version 3.0
with 128K of fast dynamic RAM and an 8K
Monitor/BIOS Eprom — all standard.

The floppy disk controller handles 3.5", 5.25", 8" and combinations of floppy disk drives. A CRT controller provides an 80 x 24 video display ready for connection to a video monitor.

Parallel keyboards and a Centronics printer are catered for by a Z80 PIO chip while a Z80 SIO provides the two RS232C serial

ports. Other features of **THE MASTER-CARD** include a battery backed real time clock, three spare 28 pin eprom sockets, 16 parallel TTL I/O lines and two expansion slots with Z80 signals.

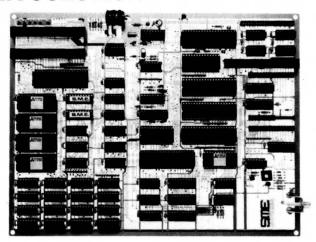
Using THE MASTER-CARD

THE MASTER-CARD is easy to use. Connect power, drives, keyboard and monitor and the job is done!

Video information from the board is connected via a standard RCA socket while all other signals for peripheral devices are brought out to standard .1 by .1 pitch connectors. Power is connected via a six pin plug on the board.

As with all SME Systems boards and systems, FULL BIOS SOURCE CODE is provided on a 5.25" 80 track disk (8" format optional) along with the ready to run CP/M Plus. This allows systems implimentors and hobbyists to tailor their boards to suit a specific task.





The Master-Card Single Board Computer

The KNIGHT-2002

The **KNIGHT-2002** is a complete ready to use CP/M Plus microcomputer based on the powerful **MASTER-CARD** single board computer.

Features of this machine are its industry standard CP/M Plus, 128K byte memory, dual 1 Mb fast 3 Ms step drives and high quality ergonomic screen and keyboard.

quality ergonomic screen and keyboard. The KNIGHT is housed in an attractive grey plastic case with the monitor placed on top and the keyboard located at the front.

KNIGHT-2002 is aimed at the smaller business and advanced hobbyist market where the 1 Mb floppy disks provide enough storage for most normal needs.

Software for KNIGHT can be chosen from the world wide market since KNIGHT uses the industry standard CP/M-80 (Plus) operating system and will run all standard CP/M programs.

Included with KNIGHT is the Utilities disk along with a comprehensive operator and technical manual that guides the user through startup, operation and repair of the unit

The KNIGHT-2026

The **KNIGHT-2026** is an expanded **KNIGHT-2002** with a half height 26 Mb mini Winchester hard disk drive replacing one of the floppy disk drives.

Supplied with this KNIGHT are programs to allow backing up data from the hard disk to floppies giving complete data security.

The combination of hard disk and KNIGHT features make this computer one of the most powerful and fast computers in its class.

This high capacity unit is primarily designed for the needs of larger businesses where stock, payroll and accounting data far exceed the capabilities of floppy disks.

THE MASTER-CARD Specifications

Specification	13
CPU	Z80 @ 4 Mhz
RAM	
	8 K MonBios Eprom
	3 Spare 28 pin sockets
KEYBOARD	Parallel Keyboard Port
DISPLAY	80 x 24 CŔT Display
	Eprom
SERIAL PORTS	2 by RS232C Serial
BAUD RATE	Software Programmble
PRINTER	1 Centronics Printer Port
TTL I/O	20 TTL I/O Lines
DISKS	8" Floppy Disk Support
	5.25" Floppy Disk Support
	Winchester via add-on
	card
	CP/M Plus version 3.0
CLOCK	Real Time, Backed
EXPANSION	
PCB	Resist, Legend, Plated
	Thru Double sided
SIZE	215 x 280 (8.5" x 11")
POWER	+5 v @ 1.2A, +12 v /-12 v
	@ 0.1A

KNIGHT-2002 Specifications

* ALL the features of THE MASTER-CARD KEYBOARD........87 keys, Tactile feedback FUNCTION KEYS

	Yes, 10 programmable
KEYPAD	Numeric + Cursor
ERGONOMIC	Yes, low profile with tilt
DISPLAY	Separate Green Video
	Monitor
DISKS	2 x 1 Mb DSDD
EXPANSION	2 Free slots
SIZE	120h x 465w x 430d

KNIGHT-2026 Specifications

* The KNIGHT-2002 plus the following.
DISKS1 x 1 Mb Kb floppy disk 1
x 26 Mb hard disk
EXPANSION 1 Free slot

* All disk sizes unformatted



	EXEMPT	IAX
MASTER-CARD (with CP/M Plus)	\$ 895.00	\$125.30
KNIGHT-2002 1 + 1 Mb	\$1,995.00	\$279.30
KNIGHT-2026 1 + 26 Mb	\$3,995.00	\$559.30
Video Monitor (Green screen)	\$ 175.00	\$ 24.50
Hard disk interface (#3100)	\$ 175.00	\$ 24.50
Wire wrap card (#3120)	\$ 40.00	\$ 5.60
Utility Disk and manual	\$ 50.00	\$ 7.00

* Prices and Specs. Subject to change without notice.

* Trade Enquiries welcomed.



180,000 Components for Peanuts!

Siemens, a world leader in high technology electronic components is even better known for relentless quality control. And now Siemens is offering memory I.C.'s at a lower price.

Both 128 and 256 refresh cycle I.C. memory parts are available immediately. Each 16 pin dual in line package delivers 180,000 components - mostly transistors and capacitors - in its silicon chip. That's more than 600 components for less than 1 cent!

Siemens Ltd. 544 Church Street, Richmond. Vic. 3121. Telephone: 420 7318 Sydney 436 8730

Siemens Memory I.C.'s. High quality. New low price.

KEYBOARD ENCODER

This straightforward design uses common components — no special encoder IC — and features alpha-lock and repeat functions.

Andrew Cousins



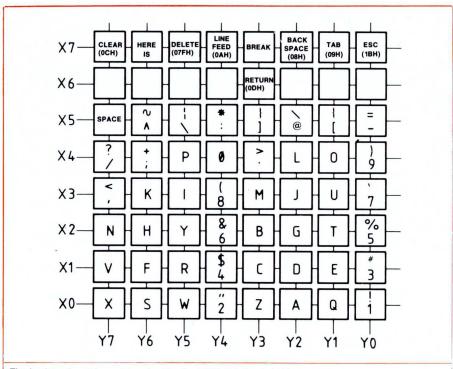
THIS KEYBOARD ENCODER uses only seven ICs (six TTLs and one EPROM) and eight transistors. By programming the EPROM with the appropriate data the encoder can be made to match any keyboard, no matter how strange the layout.

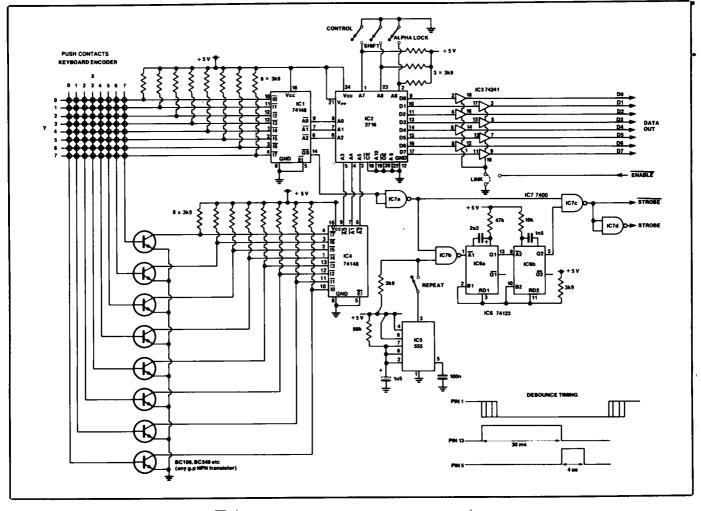
When a key is pressed in the matrix, connecting an X and Y line, one of the transistors is turned on, pulling an input to IC4 low. The base current in the transistor is enough to pull an input to IC1 low.

ICI and IC4 are 8-line to 3-bit binary encoders, i.e: the output is a 3-bit binary number representing the selected input. The 3-bit output from each encoder is combined into six bits and used as the six low address lines to IC2, the 2716 EPROM. Therefore, each key can select a particular location in a 64-byte block.

To generate the control, shift and alphalock characters the address lines A6, A7 and A8 are used to select a particular 64-byte block in IC2. Each block in this EPROM represents a combination of control, shift and alpha-lock. Whatever location is selected, the data appears at the output lines of IC2 and is buffered by IC3.

The shift lock (really an alpha-lock with my PROM) assumes the keyboard has a mechanical lock on this key. However, it should not be difficult to add a flip-flop in a toggle mode for other keyboards.





To generate the strobe pulse the \overline{GS} (active low) output of one of the 74148 encoder chips is used. This signal goes low whenever any input to the 74148 is active (low). Therefore, \overline{GS} is used to trigger the debounce and strobe circuitry.

The monostable IC6a provides a 30 ms delay to debounce the keyswitch contacts. At the end of 30 ms IC6a triggers IC6b to

provide a short strobe pulse.

I suggest that the strobe pulse should be lengthened by changing the values of the resistor and capacitor connected to IC6b. The time constants for the debounce circuit are a result of the components that I had on hand during construction.

The GS signal is actually gated with the output of a 555 before going into IC6a. This

555 is running in a stable mode at about 10 Hz to provide a repeat facility. When the repeat key is closed the input to IC6a is a square wave at this frequency.

Only a quarter of the EPROM is used. As there are still two address lines on the EPROM not used it would be possible to utilize these to provide more options for the keyboard eg a double shift.

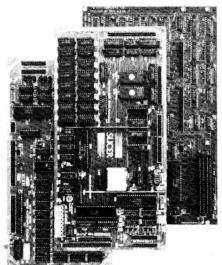
Table 1. EPROM listing.

00001	Define the prom for the Keyboard encoder	00024 0050 205E5U3A	byte "	· , ·^^·, ·\· , ·; · , ·] · , '0 · , '[· , ·- ·
00002	; Key not pushed in = 1 (logic high)	00024 0054 5D405B2D		
00003	;	00025 0038 2F3R1030	byte '/	' ,'; ,10h ,'0' ,'.' ,0ch ,0fh ,"9"
00004	;	00025 005C 2E0C0F39		
00005	;	00024 0040 20000938	byte ',	* ,0bh ,09h ,*8° ,0dh ,0ah ,15h ,*7°
00006	· •	00026 0064 0D0A1537		
00007 0000 >	org 00	00027 0068 0E081936	byte 0e	h ,08h ,19h ,"6" ,02h ,07h ,14h ,"5"
00008	· • · · · · · · · · · · · · · · · · · ·	00027 006C 02071435		
00009	;shift=0 ctrl=0 alpha lock=0	00028 0070 16061234	byte 16	h ,06h ,12h ,"4" ,03h ,04h ,05h ,"3"
00010	·	00028 0074 03040533		
00011 0000 0C1B7F0A	byte 00Ch,01Bh,07Fh,00Ah,01Bh,00Bh,009h,01Bh	00029 0078 18131732	byte 18	3h ,13h ,17h ,°2° ,1ah ,01h ,11h ,°1°
00011 0004 1B08091B		00029 007C 1A011131		
00012 0008 0000001B	byte 000h,000h,000h,01kh,000h,000h,000h,000h	00031		
00012 0000 00000000		00032	; 50117=0 61	trl=1 alpha lock=0
00013 0010 205ESC3A	byte ' ' ,'^^','\' ,':' ,']' ,'@' ,'[' ,'-'	00033	;	
00013 0014 SD40SB2D		00034 0080 OC187F0A	byte 00	OCh, 01&h, 07Fh, 00Ah, 01&h, 008h, 009h, 01&h
00014 0018 2F3R1030	byte "/" ,";" ,10h ,"0" ,"." ,0ch ,0fh ,"9"	00034 0084 1E08091E		
00014 001C 2E0C0F39		00035 0088 0000001F	byte 00	00h,000h,000h,01Bh,00Dh,000h,000h,000h
00015 0020 20080938	byte ',' ,0bh ,09h ,'8' ,0dh ,0ah ,15h ,'7'	00032 0030 01000000		•
00015 0024 0D0A1537		00036 0090 207E7C2A	byte *	* ,*** ,*!* ,*** ,*}* ,** ,** ,* { * , * =*
00016 002B 0E081936	byte Oeh ,08h ,19h ,"6" ,02h ,07h ,14h ,"5"	00036 0094 70607830		
00016 0020 02071435		00037 0098 3F2F7030	byte "	7' ,'+' ,'p' ,'O' ,'-' ,'1' ,'o' ,')'
00017 0030 16061234	byte 16h ,06h ,12h ,"4° ,03h ,04h ,05h ,"3°	00037 009C 3E8C6F29		
00017 0034 03040533		00038 00A0 305E6928	byte .	ሩት ያቸርት ያቸኳት ያቸርት ያቸጠት ያቸውት ያቸዉት ያቸላለት ።
00018 0038 18131732	byte 18h ,13h ,17h ,°2° ,1ah ,01h ,11h ,°1°	00038 00A4 6B6A7027		
00018 003C 1A011131		00039 00A8 6E687926	byte *	n' ,'h' ,'y' ,'%' ,'b' ,'g' ,'t' ,'%'
00019		00039 00AC 62677425		
00020	;shift=0 ctrl=0 alpha lock=1	00040 0080 76667224	byte *	v* , 'f* , 'r' , '\$* , 'c' , 'd' , 'e* , '#'
00021		00040 0084 63646523		
00022 0040 0C1B7F0A	byte 00Ch,01Eh,07Fh,00Ah,01Eh,008h,009h,01Eh	00041 00B8 78737722	byte .	x' ,'s' ,'w' ,'^'','z' ,'a' ,'q' ,'''
00022 0044 1B03091B		00041 00FC 7A617121		
00023 0048 0000001B	byte 000h,000h,000h,018h,000h,000h,000h	00042	;	
00023 0040 00000000	· · · · · · · · · · · · · · · · · · ·	-		

00043	;shift=0	ctrl=1 alpha lock=1	00072 0160 2C0B0938	byte	"," ,0bh ,09h ,"8" ,0dh ,0ah ,15h ,"7"
00044	:	****	00072 0164 0D0A1537		
00045 00C0 0C1B7F0A	byte	00Ch,01Bh,07Fh,00Ah,01Bh,00Bh,009h,01Bh	00073 0168 0E081936	byte	0eh ,08h ,19h ,"6" ,02h ,07h ,14h ,"5"
00045 00C4 1E08091E 00046 00CB 0000001E	byte	000h 000h 000h 045h 005h 005h 005h	00073 0160 02071435		
00046 00CC 0D000000	Dyce	000h,000h,000h,01Bh,00Dh,000h,000h,000h	00074 0170 16061234	byte	16h ,06h ,12h ,"4" ,03h ,04h ,05h ,"3"
00047 00D0 207E7C2A	byte	,.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	00074 0174 03040533		
00047 0004 70607830	Dyce	, , , , , , , , , , , , , , , , , , , ,	00075 0178 18131732	byte	18h ,13h ,17h ,"2" ,1ah ,01h ,11h ,"1"
00048 00D8 3F2B5030	byte	'?' ,'+' ,'P' ,'0' ,'>' ,'L' ,'0' ,')'	00075 017C 1A011131		
00048 00DC 3E4C4F29	0,00	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	00077 00078	,	
00049 00E0 3C4B4928	byte	'<' ,'K' ,'I' ,'(' ,'M' ,'J' ,'U' ,'^/'	00078	, 50176-1	ctrl=1 alpha lock=0
00049 00E4 4D4A5527	-,	. , ., , , , , , , , , , , , , , , , ,	00080 0180 0C187F0A	byte	OOCh,01Bh,07Fh,00Ah,01Bh,008h,009h,01Bh
00050 00E8 4E485926	byte	'N' ,'H' ,'Y' ,'&' ,'B' ,'G' ,'T' ,'X'	00080 0184 18080918	0,00	00cm,015m,07Fm,00Am,018m,008m,009m,018m
00050 00EC 42475425			00081 0188 00000018	byte	000h,000h,000h,01Eh,00Dh,000h,000h,000h
00051 00F0 56465224	byte	'V' ,'F' ,'R' ,'\$' ,'C' ,'D' ,'E' ,'*'	00081 0180 00000000	D, 0E	00011,00011,01211,00211,00011,00011,00011
00051 00F4 43444523			00082 0190 205E5C3A	byte	',.,.', '.:. ',.]. '.6. '.[. '
00052 00F8 58535722	byte	"X" , "S" , "W" , "^", "Z" , "A" , "Q" , "!"	00082 0194 50405820	0,00	, , , , , , , , , , , , , , , , , , , ,
00052 00FC 5A415121			00083 0198 2F3B5030	byte	'/' ,';' ,'F' ,'O' ,'' ,'L' ,'O' ,'9'
00054	;		00083 019C 2E4C4F39		
00055	; shift=1	ctrl=0 alpha lock=0	00084 01A0 2C4B4938	byte	',' ,'K' ,'I' ,'8' ,'M' ,'J' ,'U' ,'7'
00056	;		00084 01A4 4D4A5537		
00057 0100 0C1B7F0A	byte	00Ch,01Bh,07Fh,00Ah,01Bh,00Bh,009h,01Bh	00085 01A8 4E485936	byte	'N' , 'H' , 'Y' , '6' , 'B' , 'G' , 'T' , '5'
00057 0104 1B08091B			00085 01AC 42475435		
00058 0108 0000001B	byte	000h,000h,000h,01Bh,00Dh,000h,000h,000h	00086 01B0 56465234	byte	'V' ,'F' ,'R' ,'4' ,'C' ,'D' ,'E' ,'3'
00058 010C 0D000000			00086 01B4 43444533		
00059 0110 205E5C3A	byte	'.v.'.'. '.:. '.]. '.6. '.[. '	00087 0188 58535732	byte	"X" , "S" , "W" , "2" , "Z" , "A" , "Q" , "1"
00059 0114 5D405B2D 00060 0118 2F3B1030	byte	1/1 1/1 105 101 1 1 0-5 005 101	00087 01BC 5A415131		
00060 0116 2F381030	Dyte	"/" ,";" ,10h ,"0" ,"." ,0ch ,0fh ,"9"	00088	;	
00061 0120 2C0B0938	byte	"," ,0bh ,09h ,"8" ,0dh ,0ah ,15h ,"7"	00089	; shift=1	ctrl=1 alpha lock=1
00061 0124 0D0A1537	Dyce	, , , oon , oon , oon , oon , 13n , -/-	00070	;	
00062 0128 0E081936	byte	Oeh ,08h ,19h ,"6" ,02h ,07h ,14h ,"5"	00091 01C0 0C1R7F0A	byte	00Ch,01Bh,07Fh,00Ah,01Bh,00Bh,009h,01Bh
00062 012C 02071435	5,00	ven your y17m y 0 y02m y07m y14m y 0	00091 01C4 1B08091B		
00063 0130 16061234	byte	16h ,06h ,12h ,"4" ,03h ,04h ,05h ,"3"	00092 01C8 0000001B 00092 01CC 00000000	byte	000h,000h,000h,01Rh,00Dh,000h,000h,000h
00063 0134 03040533		10 / 10 / 12 / 1 / 10 / 0 / 0	00093 01D0 205E5C3A	L	
00064 0138 18131732	byte	18h ,13h ,17h , 2° ,1ah ,01h ,11h , 1°	00073 01D4 5D405B2D	byte	· · , ·^^·, ·\· , ·:· ,·:· ,·e· ,·[· ,·-·
00064 013C 1A011131		/ / /- / / / / / /	00094 0108 2F387030	byte	'/' ,';' ,'p' ,'0' ,'.' ,'1' ,'o' ,'9'
00065	;		00094 01DC 2E6C6F39	D, CE	, , , , b , o , . , . , . 1 , . o , . y .
00066	; shift=1	ctrl=0 alpha lock=1	00095 01E0 2C6R6938	byte	"," ,"K" ,"i" ,"B" ,"m" ,"j" ,"u" ,"7"
e 00057	;		00095 01E4 6D6A7537	0,00	, , , , , , , , , , , , , , , , , ,
00068 0140 0C187F0A	byte	00Ch,01Bh,07Fh,00Ah,01Bh,008h,009h,01Bh	00096 01E8 6E687936	byte	'n' ,'h' ,'y' ,,'6' ,'b' ,'g' ,'t' ,'5'
00058 0144 1B08091B			00096 01EC 62677435	-,	, , , , , , , , , , , , ,
00069 0148 0000001B	byte	000h,000h,000h,01Bh,00Dh,000h,000h,000h	00097 01F0 76567234	byte	'v' ,'f' ,'r' ,'4' ,'c' ,'d' ,'e' ,'3'
00069 014C 0D000000			00097 01F4 63646533	5.00	
00070 0150 205E5C3A	byte	',,,,,,,, ':. '.]. '.6. '.[. '	00098 01F8 78737732	byte	'x' ,'s' ,'w' ,'2' ,'z' ,'a' ,'q' ,'1'
00070 0154 5D405R2D	W		00098 01FC 7A617131		The second secon
*00071 0158 2F3R1030	byte	"/" ,";" ,10h ,"0" ,"." ,0ch ,0fh ,"9"	00099		
00071 015C 2E0C0F39			00100		•
			•		

NOW AVAILABLE IN AUSTRALIA! A LEADING POWERFUL SINGLE BOARD COMPUTER

Slicer—the system that grows with your needs.



THE SLICER Real 16 Bit Power on a Single Board— Featuring the Intel 80186

- Complete 8 MHz 16-bit microprocessor on a 6" x 12" board 256K RAM, plus up to 64K EPROM
- SASI port for hard disk controller
- Two full function RS232C serial ports with individually programmed transmission rates-50 to 38.4K baud
- Software compatibility with the 8086 and 8088 8K of EPROM contains drivers for peripherals, commands for hardware checkout and software
- Software supports most types and sizes of disk drives
- Source for monitor included on disk
- Bios supports Xebec 1410 and Western Digital WD 1002 SHD controller for hard disks.

Fully assembled and tested only \$1400. Also available in several kit forms.

THE SLICER SYSTEM **EXPANSION BOARD** For expanded memory, additional ports and real time clock

- Up to 256K additional dynamic RAM
- 2 RS232C asynchronous ports with baud rates to 38.4K for serial communication

- 2 additional serial ports for asynchronous RS232C or synchronous communication (Zilog 8530 SCC)
- Real Time Clock with battery backup for continuous timekeeping
- Centronics type parallel printer port. Fully assembled and tested only \$1050. Available in several kit forms also.

THE SLICER PC EXPANSION BOARD Gives your Slicer high performance video capability

- IBM compatible monochrome video
- Video memory provides 8 pages of text or special graphics capability
- 2 IBM type card slots for color video, I/O expansion, etc.
- IBM type keyboard port.

Fully assembled and tested only \$1200 Available in several kit forms also.

Also available: The Slicer 80188 system. 51/4" form factor. Call or write for more information. Operating systems are CP/M 86 by Digital Research, Inc. \$300 and MS DOS by Microsoft Corporation \$300.

CCP/M-86 \$450, 8MHZ 8087 option \$1600.

Bankcard, MasterCard, Diners Club and American Express. Allow four weeks for delivery. Prices subject to change without notice.

Contact for further details Australian Distributor:

H&H Busicom Systems

SLICER 221 Eastern Valley Way, Middle Cove, NSW 2068. (P.O. Box 192, Northbridge, NSW 2063) Telex: Y/Money AA71408. Directors: Barrie Hall B.E. (Elec.) Syd. lan Huntley B.A. Syd. Telephone: (02) 95 3966; (02) 95 4216.

NOTE:

- Australian dollar prices quoted as \$1 Aust: 65 cents US exchange rate
- (ii) Prices do not include generally applicable 20 per cent sales tax.
- (iii) Prices for multiple orders on request.

Turbine

C. Will, Golden Square Vic 3555

Fast moving graphics are generally beyond the capabilities of BASIC. One way of developing real time graphics for the Microbee combines BASIC and Machine Code to obtain fluid motion.

The program appears rather short but it uses about 10K of memory. Most of it is used to store the graphics information. The program creates a turbine in HIRES graphics and stores it in 1K of memory. The turbine is then incremented by 4.4 degrees and stored in the next 1K of memory. This is done nine times. To obtain the illusion of movement, each 1K block is recalled in rapid succession to the screen and PCG RAM.

Four machine code routines are used. The first block moves the first 38 characters from PCG RAM to main memory. The second block moves the centre portion of screen RAM to main memory. The last two routines simply recall this information back to PCG RAM and Screen RAM. The machine code for these routines is stored in the first REM statement so it is vitally important it is typed in exactly as shown in the listing at line No. 1.

Also note that lines 100 to 420 are deleted after the first RUN. The reason for this is that on subsequent RUNs, the memory doesn't need reloading with graphics data so be sure you make a copy to tape before running this program.

PROGRAM DESCRIPTION

Line 0400

PROGRAM DE	SCRIPTION
Line 0001	: Reserves memory for the machine code
Lines 0100-0170	: Initialisation page
Lines 0200-0250	: Pokes machine code into reserved memory
Lines 0260-0270	: Initialises variables
Line 0290	: Frame counter
Line 0300	: Increments next frame by 4.4 degrees
Lines 0320-0360	: Plots turbine to screen
Line 0370	: Block moves PCG to main memory
Line 0380	: Updates memory pointer
Line 0390	: Block moves screen RAM to main memory

process for next frame
Line 0450 : Traps stack overflow. Restarts program
Lines 0460-0490 : Resets memory pointer, loads

PCG & screen RAMs from memory

Lines 0500-0510 : Determines rotation speed.

Detects the ninth frame.

: Update memory pointer, repeat

```
ØØØØ1 REM123456789Ø123456789Ø123456789Ø123456789Ø1234
00100 REM *** TURBINE - Real Time Graghics Demonstration ***
00110 CLS : CURS 145 : PRINT [A30 42]
00120 CURS 284 : INVERSE : PRINT " TURBINE " : NORMAL
ØØ13Ø CURS 471 : PRINT "REAL TIME GRAPHICS"
ØØ14Ø CURS 6Ø1 : PRINT "DEMONSTRATION"
ØØ15Ø CURS 785 : PRINT [A3Ø 42]
ØØ16Ø CURS 92Ø : PRINT "By Col Hill 1984"
ØØ17Ø PLAY Ø.5Ø
ØØ18Ø REM *** INITIALISE ***
ØØ19Ø HIRES
00200 FOR I=2309 TO 2352 : READ D : POKE I,D : NEXT I
ØØ21Ø REM *** DATA FOR "USR" ROUTINES ***
00220 DATA 33,0,248,80,89,1,112,2,237,176,201
ØØ23Ø DATA 17, Ø, 248, 96, 1Ø5, 1, 112, 2, 237, 176, 2Ø1
ØØ24Ø DATA 33,16Ø,241,8Ø,89,1,255,Ø,237,176,2Ø1
00250 DATA 17,160,241,96,105,1,255,0,237,176,201
00260 RESTORE 270 : READ P1,X1,Y1,R1,B1,E1,M
ØØ27Ø DATA 3.14159,15Ø,11Ø,3Ø,.698,Ø,4ØØØ
ØØ28Ø REM *** CREATE TURBINE ***
ØØ29Ø J=J+1 : IF J=1Ø THEN 41Ø
ØØ3ØØ E1=E1+.Ø8
00310 CURS 327 : PRINT "Loading Frame No."; J " into memory."
00320 FOR A1=E1 TO 2*P1+E1 STEP B1
ØØ33Ø A=INT(.8*R1*COS(A1)+X1) : B=INT(R1*SIN(A1)+Y1)
ØØ34Ø C=A+3Ø
ØØ<mark>3</mark>5Ø PLOT A,B TO C,B TO 18Ø,11Ø TO 15Ø,11Ø TO A,B
00360 NEXT A1
00370 USR(2309.M)
ØØ38Ø M=M+7ØØ
ØØ39Ø USR(2331,M)
ØØ4ØØ HIRES : M=M+3ØØ : GOTO 29Ø
00410 CLS: PRINT "Type ''RUN'' (CR) for Animation."
ØØ42Ø DELETE 1ØØ,42Ø
00430 CLS: INPUT "Enter speed of rotation (1 - 100) >";S
00440 IF S(1 OR S)100 THEN PLAY 1 : GOTO 430
00450 ON ERROR GOTO 450 : REM Traps Stack Overflow
00460 M=4000 : P=0
ØØ47Ø CLS : USR(232Ø,M)
00480 M=M+700
00490 USR(2342,M)
00500 FOR I=1 TO S : NEXT I : M=M+300 : P=P+1
ØØ51Ø IF P=9 THEN 46Ø ELSE GOTO 47Ø
```

"TURBINE" - Machine Code Routines

USR(2320)- Memory to PCG

0905	210018	LD	HL,F800	; Load PCG start address
0908	50	LD	D,B	; (Transfer Memory Pointer
0909	59	LD	E,C	; to DE Register pair)
D3OA	017002	LD	BC,0270	; No. of bytes to move (38 PCG Chars
CCEC	EDB	LDIR		; Block move
090F	09	RET		; Return to Basic
)- Centre sec OBJECT CODE			to Memory
ADDRESS	OBJECT CODE	MNENONIC	OPERAND	to Memory COMMENTS
			OPERAND HL,F1A0	to Memory COMMENTS ; Load centre screen start address
O91B	OBJECT CODE 21AOF1	MNENONIC LD	OPERAND	to Memory COMMENTS
O91B O91E	OBJECT CODE 21AOF1 50	MNENONIC LD LD	OPERAND HL,F1A0 D,B	to Memory COMMENTS ; Load centre screen start address ; (Transfer Memory Pointer ; to DE Register pair)
091B 091E 091F	OBJECT CODE 21AOF1 50 59	MNENONIC LD LD LD	OPERAND HL,F1AO D,B E,C	to Memory COMMENTS ; Load centre screen start address ; (Transfer Memory Pointer ; to DE Register pair)

ADDRESS	OBJECT CODE	MNEMONIC	OPERAND	COMMENTS
0910	1100F8	LD	DE,F800	; Load PCG start address
0913	60	LD	Н, В	; (Transfer Memory Pointer
0914	69	LD	L,C	; to HL Register pair)
0915	017002	LD	BC,0270	; No. of bytes to move
0918	EDBO	LDIR		; Block move
0,.0				
091A USR(2342	C)- Memory to OBJECT CODE			
091A USR(2342)- Memory to	Centre sec		creen RAM
091A USR(2342 ADDRESS 0926	')- Memory to OBJECT CODE 11AOF1	Centre sec	OPERAND DE,F1AO	creen RAM COMMENTS ; Load centre screen start address
091A USR(2342 ADDRESS 0926 0929)- Memory to OBJECT CODE 11AOF1	Centre sec MNEMONIC LD LD	OPERAND	creen RAM COMMENTS ; Load centre screen start address ; (Transfer Memory Pointer
091A USR(2342 ADDRESS 0926	')- Memory to OBJECT CODE 11AOF1	Centre sec	OPERAND DE,F1AO	creen RAM COMMENTS ; Load centre screen start address
091A USR(2342 ADDRESS 0926 0929)- Memory to OBJECT CODE 11AOF1	Centre sec MNEMONIC LD LD	OPERAND DE,F1AO H,B	creen RAM COMMENTS ; Load centre screen start address ; (Transfer Memory Pointer
091A USR(2342 ADDRESS 0926 0929 092A	OBJECT CODE 11AOF1 60	Centre sec MNEMONIC LD LD LD	OPERAND DE,F1AO H,B L,C	creen RAM COMMENTS ; Loai centre screen start address; (Transfer Memory Pointer; to HL Register pair)

Electronic tuning fork

I. B. Crisp, Bayswater Vic. 3153

If you would like to tune up your piano, but you do not have a piano-tuner's ear . . . then a Microbee, CRO and microphone can be the answer. This program not only computes but also generates the necessary frequencies required to tune a piano (or other instrument).

I was prompted to submit this piece of software when I read Tom Moffat's article in the Microbee column in the June '84 issue. I have had this program—in essence—lying around for years, having written and used it to tune my piano. The original however was written entirely in machine code for a different computer. In this re-hash I have used only the waveform generating subroutine as a BASIC USR, and slotted the rest in as an extension to Tom Moffat's BASIC program.

The key is to trigger a CRO timebase with the reference signal from the computer. A microphone placed so that it can "hear" the sound of the strings is connected to the vertical amplifier.

Using this method, a string tuned too high will have its cycles moving to the left on the display, and conversely to the right if low. Tuning is a matter of getting as nearly as possible a stationary pattern.

As shown, the program generates frequencies having perfect fifths and stretched octaves. I have altered the power calculations to slower but more accurate routines. If you would rather have a perfect scale, simply change the value of the number in lines 260 and 270 from 1.059634023 to 1.059463094.

Each frequency is prescaled to the lowest octave of the piano. Thus the trigger frequency always lies approximately within the range 27-55 Hz, and the sweep speed should be set accordingly.

Why prescale to the lowest octave? There are two good reasons: Experience has shown that the CRO display, especially at the high end of the piano is less confusing and therefore less likely to be misinterpreted if the sweep is a low sub-multiple of the piano string frequency. If too high, a near stationary pattern is hard to find as it is moving rapidly even when nearly correct. The other reason is that the accuracy of software generated frequencies is higher the lower we go. The effect of small increments in timing loops increases in direct proportion to the frequency, and while at the low end there is a very fine adjustment, at the top this degrades to a few coarse steps which do not allow accurate setting.

The frequencies as generated are accurate to within .005%, assuming that your computer's crystal is correct. While this may not seem terribly perfect at first glace, it is in fact so close that the worst case error will be about one cycle per minute at A (440 Hz). Prospective piano tuners will find that their own physical accuracy with a tuning key will fall far short of this, no matter how much patience they have!

As for any effect on pitch, rest assured that this has a much smaller error than the wow/flutter variations which we tolerate from even the very best tape and disk players (CD excepted). For comparison, a semitone is about a 6% frequency change.

The octave numbering system has been retained from the original article by Tom Moffat; i.e. the reference A=440 Hz (the one above middle C) is in octave 0. The other octaves number + and - from this one.

The program as shown will only generate an output for notes within the keyboard range of a normal width piano. It will do the calculations and provide answers over a much wider range — as in the original article. If required the range of frequency generation may be altered by editing values in line 290.

Note also that the value of S1 in line 130 should be made equal to your Z80 clock frequency in MHz. This will make the right correction even if you are using a

```
00110 REM Original calculations by Tom Moffat
00120 REM Frequency generation by Ivan Crisp
00130 S1=2: REM **** S1 is processor speed in MHz. ****
00140 SD10: DIM N1 (2, 17)
00150 FOR J=1 TO 17
00160 READ N1(1,J),N1$(2,J)
00170 NEXTJ
00180 SD10:INPUT "ENTER A NOTE (C#,Ab,etc.)";A1$
00190 INPUT "WHAT OCTAVE (-1,0,1,etc.)";B1:B1=B1*12
00200 F=0:FOR J=1 TO 17
00210 IF A1$=N1$(2,J) THEN LET B1=B1+N1(1,J):F=1
00220 NEXTJ
00230 IF F=0 THEN PRINT" >>>IMPOSSIBLE NOTE!":GOTO 180
00240 F1=440: IF B1=0 THEN 280
00250 IF B1<0 THEN 270
00260 FOR B2=1 TO B1:F1=F1*1.059634023:NEXTB2:GOTO 280
00270 FOR B2=B1 TO -1:F1=F1/1.059634023:NEXTB2
00230 SDB:PRINT:PRINT" **NOTE FREQUENCY IS":F1;"Hz."
00290 IF F1>3600 OR F1<26 THEN PRINT"Out of range of piano- not being generated.
 :PRINT:GOTO 180
00300 DATA -9,"C",-8,"C#",-8,"Db",-7,"D",-6,"D#",-6,"Eb"
00310 DATA -5,"E",-4,"F",-3,"F#",-3,"Gb",-2,"G",-1,"G#"
00320 DATA -1,"Ab",0,"A",1,"A#",1,"BB",2,"B"
00330 IF F1>53 THEN LET F1=F1/2:GOTO 330
00340 T1=1E6/F1*S1/2-99:Z1=T1/21+.1
00350 Z=INT(Z1):Y=INT((Z1-FLT(Z))*5):Z=-Z
00360 DATA 17,0,0,33,238,46,167,237,82,233,0,0,0,0,96,105,30,1,25,210,242,46,219
,2,23B,2,211,2,24,226
00370 FOR P=12000 TO 12029:READ M:T=T+M:POKE P,M:NEXTP
00380 IF T+M<>2958 THEN PRINT"DATA ERROR IN LINE 360":END
00390 SD6:PRINT"REFERENCE FREQUENCY"; F1; "Hz. NOW BEING OUTPUT"
00400 PRINT"Fress RESET to return, then RUN"
00410 POKE 12001, Y: USR (12000, Z)
```

non-standard frequency (such as 4.43 MHz for example).

00100 REM ELECTRONIC TUNING FORK

Output is to the TAPE OUT bit (bit 1) on PIO port B only. It is not audible on the speaker as there is not much point.

Towards the top end of the piano it is possible to get false stationary patterns at incorrect frequencies. This can happen if you get one submultiple higher or lower than the correct pitch. However your ears should then tell you all is not well. If in doubt, first aurally match the string to the octave below and then

start looking for a stationary pattern. With a little practice and awareness this will cease to be a problem.

Use a good solid tuning key and don't be dismayed by the amount of force sometimes required to move tight pegs. If you need to tune the whole piano upwards appreciably, be prepared to replace a broken string or two on the way, and have to repeat the adjustments a few times until the frame settles.

Fine tuning!

CONTRIBUTORS PLEASE NOTE

All contributions to this column should be accompanied by a listing of the program from a printer. Hand written or typed listings are not acceptable.

There are two reasons for this. The first is that a listing from your computer gives us some guarantee that *you* have got the listing correct.

Secondly, if you present us with a neat final copy of your program we can use photographic techniques to reproduce it in the magazine, without risk of errors.

However, if you present us with a scrawl done on the back of someone's old fag packet it needs to be manually typed twice here, with consequent increase in labour on our part and increase in the probability of errors.

Contributors will be paid \$20 for each item published in this column. Submissions must be original programs which have not been previously published. You may send as many programs as you wish with the accompanying declaration.

"I agree to the above terms and grant Electronics Today International all rights to

publish my program in ETI Magazine or other publications produced by it. I declare that

the attached program is my own original material, that it has not previously been published and that its publication does not violate any other copyright."

* Breach of copyright is now a criminal offence.

Name

Signature

Date

Address

Postcode

JAYCAR KITS AUSSIE MADE

PLAYMASTER SERIES II MOSFET AMP KIT

a stereo amplifier that will equal or better just about any integrated commercial amplifier, regardless of price". - Leo Simpson, Editor of EA,



8 SECTOR BURGLAR ALARM

Ref. EA Jan/Feb 1985 Why buy a commercially made up unit for more when you can buy this kit and SAVE money! A unique feature of this kit is the fact that you can wire N/O and N/C alarm sensors ON THE SAME LINE

8 sectors : 2 delayed entry sectors & Steel box & Includes battery and siren driver in the price & Variable exit and entry delays.





12/230V · 300

WATT INVERTER - This unit provides up to 300VA of power at 235V from an ordinary car battery. It is ideal as a standby AC power supply. The output voltage is regulated and gives a precise 50Hz. The kit also has current limiting with ultimate therma

Shutdown
The Jaycar kit features quality conservatively rated components and complete down to the case and front panel
Ref. EA June 1982

\$195.00

MAIN FEATURES OF THE **NEW PLAYMASTER**

* Switchable pho out for MM and MC cartridges

★ Switchable phono input for MM and MC cartridges
★ Electronic signal switching
★ Full facilities for dubbing between two cassette decks
★ Monitor loop for either of two cassette decks or a signal processor
★ Click action pushbutton switches for selection of sources, dubbing
and tape monitor with LED status indicators
★ Centre detents on bass, treble and balance controls, multiple detents
on volume control

PRIKATO 6

BUSKER AMPLIFIER

Ref: EA February 1985 Fantastic, portable amplifier kit for low-level P.A., Buskers or for

Battery or mains operation Full control bass, treble and volume & 2 inputs (low and high) & 17 WATTS RMS output & Gel battery automatically recharged mains used.

INTRODUCTORY PRICE & speaker, metal chassis etc

ONLY \$ 125
PRE-CUT WOODEN CABINET to suite Cat. KA-1593

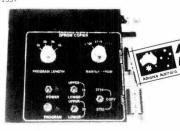
ONLY \$30.00 BUY BOTH AND PAY ONLY

49.00 A FURTHER SAVING

EPROM COPIER/PROGRAMMER

Ref. EA December 1984
This unit enables you to program 2716 & 2732 EPROMs and copy 2708, 2716 & 2732's. It is easy to make and works well. The Jaycar kit includes all PCB components (inc. ZIF sockets) and panel.

Cat. KA-1557



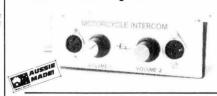
ONLY \$69.00

MOTORCYCLE INTERCOM

Ref. EA February 1984

What a great kit! This full duplex unit enables you to talk to your pinion passenger whilst driving with your helmets on! Powered by the bikes battery-you can both talk at the same time if you wish as there are no switches to activate. The Jaycar kit includes the special headphone invents and all parts. inserts and all parts. Cat. KA-1533

ONLY \$39.95



MUSICOLOR IV

Ref: EA August 1981 The ultimate lighting controller. Combines a four channel sound-to-light nannel chaser

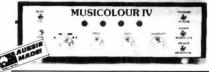
it with a four channel cha ront panel LED display different chaser patterns

Auto and manual reverse chase

Sound triggered chase Inbuilt electret microphone

Safe, opto-isolated circuitry
Cat. KA-1010

ONLY \$99.90



GREAT NEW KITS FROM ETI

Modem Kit - Ref: ETI May 1985 This brilliant new design is a price breakthrough. Never has a modern with such SOPHISTICATED FEATURES been offered at such an incredibly low price. Now you can have no excuse to gain the tremendous benefits that a modern will offer viz: AUSSIE MADE!

Access to huge data banks

the critical modem chip are very low and will severely limit kit supply

ONLY \$139

IONISER KITS **LESS 20% JUNE ONLY**

Complete Kit • High efficiency emitter head • fits completely inside a high quality ABS box (NOT a metal lid) • only 2 core mains flex protrudes from the box.

Cat. KJ-6611 ONLY \$45 **LESS 20%**

Low power consumption • Produces high intensity electric field • Output around 7.5kV • Will not necessarily produce Ozone in standard orm • Ideal for those who wish to 'try' an ioniser at an economical price

Cat. KJ-6610 ONLY \$24.50 **LESS 20%**



ETI ECONOMY HOUSE/CAR ALARM MODULE . Ref. ETI May 1985

cost full feature module can form the basis of a sophisticated anti theft system

ETI 1527 Cat KE-4698 \$24.95

YOU SAVE MONEY! $\star \star \star$

ETI 153 TEMPERATURE PROBE FOR

MULTIMETERS - Ref: ETI June 1983

This simple add-on project extends the functions of your multi-meter to the measurement of temperature. It is particularly suited to digital multimeters. It can be used to measure temperature over the range from -55° C to $+150^{\circ}$ C with an accuracy of 0.5 °C or better. The Jaycar kit includes the Jiffy case and Scotchcal panel. The AD590 is supplied but not the probe case which is in fact the plastic case of a BIC biro.

Cat. KE-4033 ONLY \$19.50

Microwave Leak Detector

Ref: ETI 724 - If you own a microwave oven, your peace of mind is worth the price of this kit. Extremely simple and foolproof to build and use. Gives a positive indication of the security of your

Cat. KE-4013 ONLY \$14.95



VOCAL CANCELLER - Ref: EA April 1982

Do you think you can sing? How would you like to be the lead singer in a famous rock (or any) band? You can cancel out the lead singer from almost any stereo record and substitute your own voice or musical instrument. Complete kit including case.

Cat. KA-1430 ONLY \$ 19.50

4164-150nS DRAM 64K x 1

INCREDIBLE SPECIAL SALE
We have made a scoop purchase of National Semiconductor brand-new prime spec 64K DRAM. At the prices shown below we expect many manufacturers to buy so hurry! Quantities naturally are limited.
PLEASE NOTE that these prices INCLUDE 20% sales tax which the hobbyist MUST PAY so don't be misled by offers that may appear cheaner!

cheaper! Cat. ZZ-8420



3C-2V 75 Ohm COAX - 7 metres??

Seven metres? Well this is a pack of 7 metres of high quality coax cable. Why seven metres is beyond us except that it was thought to be the most asked for length and why not therefore prepack if? The bean counters got their sums wrong because it did not sell? 7 unterminated metres would normally cost \$3.50 Jaycar has a fair quantity of these fairly usefull lengths for only \$2.00 which amounts to a substantial sament?



Cat. HP-1360

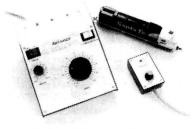
ONLY \$2.00/7 metres

FREE CATALOGUE

Ask for a FREE COPY of our 1985 Engineering Catalogue or send large SAE with 50¢ stamp.

"RAILMASTER" Pulse-Power Train Controller





Ref: EA September 1984

"We feel that it is the best controller available, regardless of cost". - John Clarke or Leo Simpson (or both) Sept. '84 This is a state-of-the-art train controller offering tremendous features.

• Variable simulated inertia • Full short circuit protection including both audible and visual indicators • Power and track monitor indicators • Adequate power for double and triple heading of locos • Fixed 12V DC and 15V AC power for lighting and accessories • Ortional walk-around throttle

Optional walk-around throttle.

The Jaycar kit includes realistic Scotchcal front panel and the special console case only available from us. The large paddle switches have been specially imported just for this kit. We believe that you will be delighted with this unit.

Cat. KA-1560 ONLY \$79.95



Diesel Sound Simulator

Rel: EA November 1984

This project mounts inside a model train (i.e. goods wagon) and produces a noise similar to a diesel locomotive. The speed varies according to the throttle action for added realism. All parts supplied.

Cat. KA-1561 ONLY \$ 19.95

Steam Sound Simulator

Ref: EA December 1984

Build this realistic steam sound simulator for your model train layout. It features an Infra-Red optical switch to synchronise the "chuffs" to the wheel rotation. Like the KA-1561 this unit picks up its power from the raikway tracks. All specified components supplied including 32 ohm bandshops the stretched headphone type transducer

Cat. KA-1562 ONLY \$15.95



JUNE SPECIAL!! Electronic Crossover Kit

NEW SHORT FORM KIT!

You can NOW build this desirable project for a lot less! There have been requests for a version of this kit that can be built into other equipment. This is it!

The kit contains PCB and all board components etc. The box (inc.)

front panel) and selector switches are not supplied but everything else! Special price for June only. Cat. KA-1571

ONLY \$79.00

SOUEAKY CLEAN MAINS

FILTERS * Two fantastic low cost models MS-4010 will supply up to 4 appliances. Each 240V socket is isolated from the cother, i.e. interference from disc drives is de-coupled from the CPU power supply etc. It will supply up to 4 outlets with a total load of 6 amps (unswitched).

ONLY \$125.00

Single 10 amp line socket type filter (unswitched). Cat. MS-4012

ONLY \$34.95



TWO PLUGPACK AND DC CONVERTOR BARGAINS!

© 250mA (max). A switch on the back of the unit changes the voltage. It is also supplied with a 1.6m cord, polarity reversing plug and multiway connecting plug. We have over 500 of them.
This voltage range is fairly useless except for small transistor radios, calculators etc. At this price however, it's worth having one or two for the inevitable occasion when such a power source is required.

Cat. MP.3002

Cat MP-3002

ONLY \$2.95

You could pay over \$10 elsewhere!



DE CONVEPTOP This unit plugs into your car cigarette lighter socket and will provide up to 300mA at 6 and 9V DC. Ideal to power the Ghetto Blaster in your car! We only have just over 200 so hurry!

Normally sell for around \$10. This month \$4.95 · 1/2 price!!



Incorporating ELECTRONIC AGENCIES

NUMBER 1 FOR KITS MAIL ORDER HOTLINE (02) 646 1300 COMET ROAD FREIGHT ANYWHERE IN AUSTRALIA ONLY \$12

N.S.W. SHOWROOMS

SYDNEY: 117 York Street. Tel. (02) 267 1614
CARLINGFORD: CIT. Carlingford & Pennant Hills Road. Tel. (02) 872 4444
CONCORD: 115/117 Parnamata Road. Tel. (02) 745 3077
HURSTYILLE: 121 Forest Road. Tel. (02) 570 7000
GORE HILL: 188/192 Pacific Highway (Cnr Bellevue Avenue). 439 4799

QUEENSLAND BURANDA: 144 Logan Road. Tel: (07) 393 0777 MAIL ORDERS: P.O. Box 480, AUBURN 2144. Tel: (02) 643 2000 HEAD OFFICE: 7/9 Rawson Street, AUBURN 2144.

Tel: (02) 643 2000 Telex: 72293

SHOP HOURS SAIOP HOURS
Carlingford, Hursville & Gore Hill
Mon-Fri. 9am - 5.30pm, Thurs 8.30pm, Sat 12pm
Sydney
Mon-Fri. 8.30am - 5.30pm, Thurs 8.30pm, Sat 4pm
Concord
Mon-Fri. 9am - 5.30pm, Sat 4pm



POST & PACKING \$5 - \$9.99 \$10 - \$24.99 \$25 - \$49.99 \$50 - \$99.99 \$100 - \$198 Over \$199

COMMODORE COLUMN

COMPUTER DERBY

K. Venhoff, Toowoomba Qld

The program requires 3K extra memory (Super Expander etc.) and has facilities for betting amounts, number of bets and horse number. Lifelike animated graphics and random movements ensure an exciting and different race each time.

After each race has been run a print-out on the screen displays total betting pool (minus 10% for the house — TAB eat your heart out), the dividend payable for each winning bet and the winning horse number.

While there are only five horses, it is more than enough to empty your piggy bank at a fast rate. So open your tinnies, place your bets and get set for a great day at the track.

VIC-20

CONTRIBUTORS PLEASE NOTE

All contributions to this column should be accompanied by a listing of the program from a printer. Hand written or typed listings are not acceptable.

There are two reasons for this. The first is that a listing from your computer gives us some guarantee that *you* have got the listing correct.

Secondly, if you present us with a neat final copy of your program we can use photographic techniques to reproduce it in the magazine, without risk of errors.

However, if you present us with a scrawl done on the back of someone's old fag packet it needs to be manually typed twice here, with consequent increase in labour on our part and increase in the probability of errors.

Contributors will be paid \$20 for each item published in this column. Submissions must be original programs which have not been previously published. You may send as many programs as you wish with the accompanying declaration.

"I agree to the above terms and grant Electronics
Today International all rights to publish my program in
ETI Magazine or other publications produced by it.
declare that the attached program is my own original
material, that it has not previously been published and
that its publication does not violate any othe
copyright."
* Breach of copyright is now a criminal offence.
A THE SHARE SHEET THE A SHEET

```
10 PRINT"T":POKE36879,30:H1=0:H2=0:H3=0:H4=0:H5=0:BS=0
15 PRINT"BETTING VALUE?
20 INPUT"CENTS";C
     PRINT: PRINT: PRINT
30 INPUT"NUMBER OF BETS?"; BT
35 BS=BS+BT
36 PRINT:PRINT
40 INPUT"HORSE NUMBER?";HS
45 IFHS=1THENH1=H1+BT
     IFHS=2THENH2=H2+BT
47 IFHS=3THENH3=H3+BT
48 IFHS=4THENH4=H4+BT
49 IFHS=5THENH5=H5+BT
50 PRINT:PRINT"ANY MORE BETS? Y=YES"
55 INPUT YN$
95 PRINT"3":POKE52,28:POKE56,28
60 IFYN≸="Y"THENPRINT"D":PRINT"BETTING VALUE="C:PRINT:GOTO30
97 POKE36869,255
98 FORI=7168T07679:POKEI,PEEK(I+25600):NEXT
99 FORI=0T095:READA:POKEI+7432,A:NEXT
100 DATA0,6,0,0,0,0,1,2
105 DATA0,0,0,96,224,96,224,224
110 DATA21,63,127,207,28,41,70,32
115 DATA224,252,251,248,56,41,70,32
120 DATA0,0,0,0,1,0,1,10
125 DATA0,0,0,192,192,192,224,224
130 DATA29,63,111,15,28,40,72,132
135 DATA224,252,250,249,56,72,136,68
140 DATA0,0,0,0,255,255,255,255
145 DATA60,60,60,60,60,60,60,60,60
155 DATA0,0,0,0,0,0,0,0
500 PRINT"3":POKE36879,121:CO=30720:VC=1
 510 SC=7810:SB=7854:SD=7898:SE=7942:SF=7986
520 P=7747
530 FORI=7724T07745:POKEI,41:NEXT
531 FORI=8032T08053:POKEI,41:NEXT
535 POKE36878,15:
536 READG:IFG=-1THEN570
       READG1:READG2
537
538 POKE36875,G:POKE36876,G1
539 FORN=1TOG2:NEXTN:POKE36875,Ø:POKE36876,Ø
540 FORN=1T020:NEXTN:G0T0536
570 POKE36875,0:POKE36876,0:GOT0599
575 DATA195,195.3,50,209,209.3,50,225,225.3,50,225,225.3,50,225,225.3,50
576 DATA219,219.3,50,219,219.3,50,219,219.3,50,209,209.3,50
576 DATA21
577 DATA21
578 DATA-1
       DATA219,219.3,50,209,209.3,50,195,195.3,1000
599 TI$="000000"
600 POKESC+CO.0:POKESC+1+CO,2:POKESC+22+CO,0:POKESC+23+CO,0
610 POKESC,33:POKESC+1,34:POKESC+22,35:POKESC+23,36
620 POKE36878,VC:NT=INT(RND(1)*20)+130:POKE36877,NT
       VC=VC+.1
630
640 IFVC>14THENVC=13
700 POKESB+C0,2:POKESB+1+C0,2:POKESB+22+C0,2:POKESB+23+C0,2
710 POKESB,33:POKESB+1,34:POKESB+22,35:POKESB+23,36
800 POKESD+C0,1:POKESD+1+C0,3:POKESD+22+C0,1:POKESD+23+C0,1
810 POKESD,33:POKESD+1,34:POKESD+22,35:POKESD+23,36
810 POKESD-33: POKESD+1:34: PORESD+22:35: POKESD+23:36

900 POKESE+C0:0: POKESE+1:C0:0: POKESE+22+C0:0: POKESE+23+C0:0: 

910 POKESE:33: POKESE+1:34: POKESE+22:35: POKESE+23:36

1000 POKESF+C0:2: POKESF+1+C0:2: POKESF+22+C0:2: POKESF+23+C0:2

1010 POKESF:33: POKESF+1:34: POKESF+22:35: POKESF+23:36

1490 POKEP:32: POKEP1:32: POKEP2:32: POKEP3:32: POKEP4:32: POKEP5:32
1520 P=P+1
1530 IFP>7753THENP=7747
1530 IFP>7753THENF=7747
1535 P1=P+7:P2=P+14:P3=P+308:P4=P+315:P5=P+322
1540 P0KEP,42:P0KEP1,42:P0KEP2,42:P0KEP3,42:P0KEP4,42:P0KEP5,42
2000 P0KESC+C0,0:P0KESC+1+C0,2:P0KESC+22+C0,0:P0KESC+23+C0,0
2010 P0KESC,37:P0KESC+1,38:P0KESC+22,39:P0KESC+23,40
2100 P0KESB+C0,2:P0KESB+1+C0,2:P0KESB+22+C0,2:P0KESB+23+C0,2
2110 P0KESB,37:P0KESB+1,38:P0KESB+22,39:P0KESB+23,40
2200 P0KESD+C0,1:P0KESD+1+C0,3:P0KESD+22+C0,1:P0KESD+23+C0,1
2210 P0KESD,37:P0KESD+1,38:P0KESD+22+C0,1:P0KESD+23+C0,1
2210 P0KESD,37:P0KESD+1,38:P0KESD+22+C0,1:P0KESD+23+C0,1
2300 POKESE+CO, 0: POKESE+1+CO, 0: POKESE+22+CO, 0: POKESE+23+CO, 0
2310 POKESE,37:POKESE+174070:POKESE+22,39:POKESE+23,40
2400 POKESF+C0,2:POKESF+1+C0,2:POKESF+22+C0,2:POKESF+23,40
2400 POKESF,37:POKESF+1,38:POKESF+22,39:POKESF+23,40
2500 IFSC=7791THENHW=H1:WH=1:GOTO6000
2500 IFSC=7791THENHW=H2:WH=2:GOTO6000
2510 IFSB=7835THENHW=H2:WH=2:GOTO6000
2520 IFSD=7879THENHW=H3:WH=3:GOTO6000
2530 IFSE=7923THENHW=H4:WH=4:GOTO6000
2540 IFSF=7967THENHW=H5:WH=5:GOTO6000
3000 M=INT(RND(1)*9)
3010 IFM=0THENPOKESC,32:POKESC+1,32:POKESC+22,32:POKESC+23,32:SC=SC-1
```

```
$015 IFM=2THENPOKESB,32:POKESB+1,32:POKESB+22,32:POKESB+23,32:SB=SB-1
3020 IFM=4THENPOKESD,32:POKESD+1,32:POKESD+22,32:POKESD+23,32:SD=SD-1
3025 IFM=8THENPOKESE,32:POKESE+1,32:POKESE+22,32:POKESE+23,32:SE=SE-1
3030 IFM=6THENPOKESF,32:POKESF+1,32:POKESF+22,32:POKESF+23,32:SF=SF-1
5000 GOTOGO0
6000 FORI=7746T08010STEP2:POKEI,43:NEXT:PRINT"
€TIME="TI$
6001 FORI=15T000STEP-.05:POKE36878,I:NEXT
6002 POKE36877,0:POKE36878,0
6020 FORI=1T02000:NEXT
6021 GOSUB6500
6030 GETG$*:IFG$<\"\"ANDG$<\"\"THEN6030
6040 IFG$*\"\"THENPRINT\"\"\":FORI=1T01000:NEXT:RUN10
6050 PRINT\"\"\":END
6500 WN=INTCX*BS-(C*BS)/10)
6501 POKE36869,240
6502 PRINT\"\"\"PRINT\"PRINT\"PRIZE-POOL=\"WN
6503 IFHW=0THENPRINT:PRINT\"NO DIVIDEND\":GOTO6521
6510 DE=INT(WN/HW)
6520 PRINT\"\"\"PRINT\"PRINT\"NO DIVIDEND\":GOTO6521
6511 DE=INT(WN/HW)
6522 PRINT:PRINT\"PRINT\"WINNER WAS HORSE NO\"WH
6522 PRINT\"PRINT\"PRINT\"NO ENTER BETS FOR NEXTRACE PRESS KEY Y\"
6525 RETURN
```

DEC-HEX

P. Owen, Busselton, WA 6280

This is a simple program for converting dec to hex. It is useful when you are planning a machine code program on paper and you need to find the memory space 543 spaces past the start of the program (543 was merely the number my internal random number generator picked out). It can work out any number between 0 (0000) and 36565 (FFFF).

```
between 0 (0000) and 36565 (FFFF).

10 REM DECIMAL TO HEX CONVERSION

20 INPUT "IDECIMAL NUMBER"; N: N=N+1

30 FORQ=3TOØSTEP-1

40 FORW=ØTO15

50 IFN>W*16 1QTHENNEXTW

55 N=N-(W-1)*16 1Q

60 FORE=ØTOW-1

70 READX$

80 NEXTE

90 N$=N$+X$

100 RESTORE

110 NEXTQ

120 PRINT"HEX="N$

130 DATA "0","1","2","3","4","5",

"6","7","8","9","A","B","C",

"D","E","F"

VIC-20
```

BUDGET PLAN

Gordon Masters, Pearce, ACT 2607

This program manipulates data in the data statements at lines 70 onwards to present a budget sketch of recurrent household payments. The program fits into an unexpanded Vic with 46 such data statements. Although heavily crunched, a semblance of ordered structure remains in the program.

Line 1 sets the screen, dimensions arrays and sets ND at one less than the number of the data sets to be manipulated.

Lines 3-7 and 16-18 are subroutines.

Lines 10-15 are the main loop displaying a menu.

Lines 20-27 are a subroutine which asks for a month to be selected, prints a heading and the items associated with that month, totals the month's budget and waits for a key-press to return to the menu.

Lines 30-38 do the same for a two-month period, but omit the due day for the second month, so that these items can be distinguished easily.

Lines 40-49 do the same for a quarter, and lines 50-58 give an annual survey. The fortnightly budget figure cheats a little to allow for a spare couple of fortnights for a holiday, a pure extravagance or a calamity. The figure in the carry column shows how much should be in hand at the end of the month to allow for the planned expenditure.

The data statements from line 70 onwards are in the strict format day, month, reason, dollars. I allowed one line per item; it makes for easier amendments.

VIC-20

```
1 POKE36879,25:DIMMO$(11),T(11),C(12):ND≈4:GCT010
3 D$=RIGHT$("
               "+STR$(D),4):RETURN
5 PRINT" TOPODDEBUDGET PLANM"SPC(11)"
                                          T個":RESTORE:FORI=@TO11:READMO$(I):
NEXT: RETURN
0:RETURN
TRI"
13 PRINT" 3. NEXT QUARTER"SPC(29)"4. ANNUAL SURVEY"
15 ONAGOSUE20,30,40,50:GOTO10
16 M=INT(M-1):T=0:IFM<00RM>11THENPRINTSPC(68)"@IMPROPER MONTH":GOSUB7:RUN
18 GOSUB5: RETURN
20 GOSUB5: INPUT"WHICH MONTH": M: GOSUB16: PRINT"
                                                a"MO$(M):PRINT
21 FORE=0TOND: READA, B, C$, D IFD-1 OMTHEN26
24 GOSUB3:PRINTRIGHT#(STR#(A),2)TAB(3)LEFT#(C#,14)TAB(17)D#:T=T+D
26 NEXT
27 D=T:GOSUB3:PRINTTAB(17)"简" "B":PRINT"TOTAL"TAB(17)D$:GOSUB7:RETURN
30 GOSUB5:INPUT"FIRST MONTH";M-GOSUB16:M2=M+1:IFM=11THENM2=0
32 PRINT"
             #"MO$(M)"M&N"MO$(M2):PRINT:FORE=0TOND:READA,B,C$,D:IFB-1=M2THENS?
34 IFB-1 OMTHEN38
36 PRINTRIGHT$(STR$(A),2);
37 GOSUB3:PRINTTAB(3)LEFT$(C$,14)TAB(17)D$:T≈T+D
38 NEXT: GOSUB27: RETURN
40 GOSUE5: INPUT"FIRST MONTH": M:GOSUB16: M2=M+1: M3=M+2: IFM=10THENM3=0
42 IFM=11THENM2=0:M3=1
43 PRINT"
            #"MO$(M)"##"MO$(M2)"###"MO$(M3):PRINT:FORE=@TOND:READA,B,C$,D:IFB-1=
M3THEN47
45 IFB-1=M2THEN47
46 IFB-1<>MTHEN49
47 GOSUB3:T=T+D:PRINTMO$(B-1)TAB(4)LEFT$(C$,13)TAB(17)D$
49 NEXT: GOSUB27: RETURN
50 GOSUB5:PRINT"
                  51 PRINT" #MON. "TAB(8) "CARRY" TAB(18) "PAY"
52 FORM=0T011:T=T+T(M):NEXT:FORM=0T011:MP=M-1:IFM=0THEHMP=12
54 C(M)=C(MP)+2*INT(T/24)+2-T(M):IFC(M)(C(12)THENC(12)=C(M)
55 NEXT:FORM=0T011:D=C(M)-C(12):GOSUB3:PRINTMO$(M)TAB(8)D$;
56 D=T(M):GOSUB3:PRINTTAB(17)D#:T(M)=0:NEXT:GOSUB27
58 PRINT":TTT":PRINT"FORTNIGHTLY PAY "; INT(T/24)+1:GOSUB7:RETURN
69 DATAJAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC
70 DATA50,1, HOLIDAY EXTRAS, 300
73 DATA5,2,GORDON BDAY,30
76 DATA28,5,PHONE BILL,70
100 DATA1,7,NRMA SUBS,25
```

106 DATA25,12,CHRISTMAS PRESENTS,350



Disco World pty, Itd.

300 Main Street, Lilydale P.O. Box 509, Lilydale 3140 (03) 735-0588

AMPLIFIERS

ZPE Series II (500W) \$1300.00

DISCO MIXERS

Citronic SM 330 \$695.00 Arista \$330.00

JUMBO STROBE

\$153.48 FLA 701 Scanner S101 \$99.45 Scanner Bar \$104\$ \$342.86

HELICOPTER

\$198.00 2 ARM Spinner 4 ARM Spinner \$289.00 8 ARM Spinner \$497.89 **UFO 324** \$1698.55

PINSPOT

PS 112S \$48.94 PS 112L \$58.99

MIRROR BALLS



MB 008-8" \$37.20 MB 012 \$64.58 \$93.54 MB 014 MB 018 \$125.34

MB 020 \$153.79

SMOKE MACHINE

Great for Special Effects \$328.00

MIRROR BALL MOTORS

AC 240V \$29.99

ROLLING LIGHTS

8 x 4515 lamps \$958.95 24 lamps horizontal \$1985.45 24 lamps vertical \$1985.45



COSMOS LIGHT

24 lamps \$1980.68 Half Ball rotary light \$357.28

LAMPS all colours, soft glass

ES 240V 60W box of 25 \$75.00 BC 240V 40W box of 100 \$77.00 BC 240V 25W box of 100 \$75.00

Bankcard & Mail Orders. Power Cords not included. Trade Enquiries Welcome. Send S.A.E. for free price list.

FEDERAL MARKETING BOOK SALES

Special Publications from Electronics Today

Circuits Bookbook #5

More than 200 circuit and design ideas covering Alarms, Converters, Electronic Music, Games, Test Equipment and 18 other topics for engineers, technicians, students and hobbyists. \$3.95

Radio Experimenter's Handbook

Over 130 pages chock-full of circuits, projects to build, antennas to erect, hints and tips. This handbook covers the field from DX listening to building radioteletype gear, from twilight zone DX to VHF power amplifiers, from building a radio FAX picture decoder to designing leaded and tran dipoles loaded and trap dipoles.

Australian Scanner's World

N0283E

There's a whole world beyond 'the shortwaves' — The communications channels. This is an introduction to that world with articles on scanning and scanners, how to build and erect suitable antennas, and a computer-sorted listing of services throughout Australia and NZ; beacons are also listed. Includes a roundup of scanners, antennas and accessories.

Electronic Projects for Cars

Selected projects detail a car alarm, reversing alarm, fuel monitor, thermatic fan controller, twin-range tacho, expanded-scale ammeter and many more. Includes ideas for experimenters.

Electronics — It's Easy Vol. 1

A0001E

Electronics — It's Easy Vol. 2

Written for the intelligent layman as an introduction to electronics theory and methods. Volume 1 discusses electronics systems in general: What they do, how they do it, and how a complex electronic system can be broken down into fundamentals. Volume 2 introduces digital system theory and discusses the practical application to digital instruments, computers and peripherals, and oscilloscopes.

Electronics & Music

G0125E

Explains the application of electronics to music reproduction. Articles cover the reinforcing of acoustic instruments, multitrack recording, graphic equalisers and microphone placement techniques plus other topics as well as an effects handbook. Inlcudes seven selected

How to Build Gold and Treasure Detectors C0033E Tells you how metal detectors work and how to construct the different

types of detectors: discriminating, BFO, induction-balance and a professional deep-seeking unit.

Computer Projects Vol. 1

Will let you construct ETI's Little Big Board Computer, an all-year clock for microcomputers, a direct-connect modem, a PPI-based EPROM programmer, a cheap menu-driven expansion for the Microbee and many other projects.

Microbee Hacker's Handbook

J0291E

Will tell you how to get more from the Bee's graphics capabilities, set up for telecommunications, play music, build a joystick and light pen, get cheap hard copy, expand your 16K Bee to 32K, and more. Also lists contacts for all known Microbee user groups.

6.50

ETI Circuit Techniques Vol. 1 ETI Circuit Techniques Vol. 2

E0076E D0077E

The how, what, which, where and how much anthology of electronic, components, circuits and techniques. Volume 1 covers op-amps, 555 timer applications, CMOS, VFETs, power MOSFETs, designing with diodes and more. Volume 2 covers remote control systems, experimenting with ultrasonics, transistor arrays, junction FETs and more plus a 16-page circuit source guide.

Lab Notes and Data

B0422F

A useful source of circuit design ideas covering transistor arrays, logic troubleshooting, using solar cells, loudspeaker design, electrostatic discharge and 20 other topics. Includes an explanation of the terms and abbreviations used in semiconductor device data sheets plus 26 selected data sheets on op-amps, voltage regulators, npn and pnp semiconductors, LED displays, power transistors, and other devices.

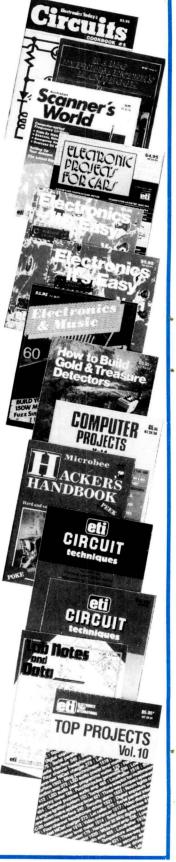
Top Projects Vol. 10

Top Projects Voi. 10
Twenty-five of the best projects from ETI: Solid state electronic switches, Video enhancer, Low cost dwell meter, Sling psychrometer, Digital exposure meter, Serial/parallel comptuer interface and 19

Order today —

Return the Freepost reply card to

Federal Marketing Book Sales PO Box 227, Waterloo 2017, NSW Tel: (02)663-9999 TIx: AA74488



Two great new services from DIXPRESS

TOLL—FREE ORDERING

Just because you're out the back of Woop Woop. why should you have to pay exorbitant STD phone charges to place an order?

Now you can order through DSXpress: the original and still the best electronics mail order supplier in Australia (and probably the world!) for the price of a local phone call. Yes, we've installed a special toll-free orderline for our STD customers. To place an order, simply call us on

(008) 22 6610

Sydney customers or enquiries, please call on our normal number — (02) 888 3200

ORDER-BY COMPUTER!

The 21st Century is here! Yes, you can now place an order for any Dick Smith Electronics products through the DSE Remote Bulletin Board System.

What is the DSE Bulletin Board? It's an electronic message, file and data handling service which any computer user can use - absolutely free of charge - courtesy of Dick Smith Electronics. All you need is a computer with a suitable communications program, an RS232C (serial) interface and a modem to connect to the telephone line. You can call the DSE RBBS at any time (24 hours per day) and now you can place an order (simply follow the directions on the menu).

Call the DSE RBBS on Sydney

(02) 887 2276

● 300 baud ● 8 data bits ● 1 stop bit ● No parity

STORE LOCATIONS

NSW								
Cnr. Swift & Young Sts.	Albury	21 8399	125 York St	Sydney	267 9111	Gympie & Hamilton Rds	Chermside	359 6255
T55 Terrace Level	Bankstown Sq.	707 4888	Brisbane St & Kable Ave	Tamworth	66 1961	Cnr Queen Elizabeth Dr & Bernard St	Rockhampton	27 9644
Shop 1, 65-75 Main St	Blacktown	671 7722	263 Keira St	Wollongong	28 3800	Cnr Gold Coast Hwy & Welch St	Southport	32 9863
613 Princess Hwy	Blakehurst	546 7744	ACT	-		Bowen & Ruthven Sts	Toowoomba	38 4300
Oxford & Adelaide Sts	Bondi Junction	387 1444	96 Gladstone St	Fyshwick	80 4944	Ingham Rd & Cowley St. West End	Townsville	72 5722
531 Pittwater Rd	Brookvale	93 0441	VIC			SÃ		
Campbelltown Mall, Queen St	Campbelltown	27 2199	Creswick Rd & Webster St	Ballarat	31 5433	Wright & Market Sts	Adelaide	212 1962
Shop 235, Archer St Entrance	Chatswood Chase	411 1955	145 McCrae St	Bendigo	43 0388	Main South & Flagstaff Rds	Darlington	298 8977
147 Hume Hwy	Chullora	642 8922	Shop 46, Box Hill Central, Main St	Box Hill	890 0699	Main North Rd & Darlington St	Enfield	260 6088
162 Pacific Hwy	Gore Hill	439 5311	Cnr Hawthorn Rd & Nepean Hwy	East Brighton	592 2366	24 Park Terrace	Salisbury	281 1593
315 Mann St	Gosford	25 0235	260 Sydney Rd	Coburg	383 4455	WA	-	
4 Florence St	Hornsby	477 6633	1150 Mt Alexander Rd	Essendon	379 7444	Wharf St & Albany Hwy	Cannington	451 8666
Elizabeth Dr & Bathurst St	Liverpool	600 9888	Nepean Hwy & Ross Smith Ave	Frankston	783 9144	66 Adelaide St	Fremantle	335 9733
450 High St	Maitland	33 7866	205 Melbourne Rd	Geelong	78 6766	William St & Robinson Ave	North Perth	328 6944
173 Maitland Rd, Tighes Hill	Newcastle	61 1896	291-293 Elizabeth St	Melbourne	67 9834	Centreway Acde, Hay St	Perth City	321 4357
Lane Cove & Waterloo Rds	North Ryde	88 3855	Bridge Rd & The Boulevarde	Richmond	428 1614	TAS		
George & Smith Sts	Parramatta	689 2188	Springvale & Dandenong Rds	Springvale	547 0522	25 Barrack St	Hobart	31 0800
The Gateway, High & Henry Sts	Penrith	32 3400	QLD			NT		
818 George St	Railway Sq	211 3777	293 Adelaide St	Brisbane	229 9377	17 Stuart Hwy	Stuart Park	81 1977
6 Bridge St	Sydney	27 5051	166 Logan Rd	Buranda	391 6233	Watch for a new store openin	o in your area!	

Quite often, the products we advertise are so popular they run out within a few days or unforeseen circumstances might hold up shipments so that advertised lines are not in the stores by the time the advert appears. And very occasionally, an error might slip through our checks and appear in the advert (after all, we're human too!) Please don't blame the store manager or staff; they cannot solve a dock strike on the other side of the world, nor fix an error that's appeared in print. If you're about to drive across town to pick up an advertised line, why not play it safe and give them a call first . . . just in case! Thanks

MAJOR RESELLERS

NSW: • Ballina: A. Cummings & Co. 91-93 River St 86 2284 • Bathurst: Electronic Shop, 74 Bentick Street, 31 4421 • Bowral: Barry Gash Electronics, 370 Bong Bong St 61 2577 • Broken Hill: Hobbies & Electronics, 37 Oxide St 88 4098 • Charlestown: Newtronics 131 Pacific Hwy 43 9600 • Coffs Harbour: Coffs Harbour Electronics, 3 Coffs Plaza, Park Ave. 52 5684 • Deniliquin: Deni Electronics, 220 Cressy St, 81 3672 • East Maitland: East Maitland Electronics, 99 High St, 33 7327 • Gosford: Tomorrows Electronics & HiFi, 68 William St, 24 7246 • Lismore: Decro 3A/6-18 Carrington St, 21 4137 • Port Macquarie: Hall of Electronics, 173 Summer St, 62 6491 • Tweed Heads: Stuarts Electronic Sales, Sh 3, 4 Stuart St. • Swansea: Swansea Electronics, 184 High St, 711674 • Wagga: Phillips Electronics 82 Forsyth St, 21 6558 • Windsor: M & E Electronics, Sh 7, Mc Ewans Arcarde, 206 George St, 77 5935 VIC: • Hamilton: John Thompson & Co, 138-148 Gray St, 72 2000 • Echuca: Webster Electronics, 220 Packeham St 82 2956 • Mildura: McWilliams Electronics 110A Langtree Ave, 23 6410 • Morwell: Morewell Electronics, 95 George St, 36 46133 • Shepparton: GV Electronics Corter 100 High St, 21 8866 QLD: • Atherton: Maatens Music Centre 55 Main St, 91 1208 • Bundaberg: PM Electronics, Takalvan St, 72 8272 • Cairns: Electronic World Shop 27 K-mart Westcourt Plaza, 518 555 • Gladstone: Purely Electronics Purely Electronics, 15 East St, 21 058 SA: • M Gambier: Hutchessons 51 1723 • Maryborough: Keller Electronics, 218 Adelaide St, 21 4559 • Rockhampton: Purely Electronics, 15 East St, 21 058 SA: • Mt Gambier: Hutchessons Communications, 5 Elizabeth St, 25 6404 • Whyalla: Eyre Electronics Shop 2 Forsythe St, 45 4764 WA: • Albany: Micro Electronics 133 Lockyer Ave 41 3432 TAS: • Launceston: Advanced Electronics 5A The Quadrant, 34 1399 NT: • Darwin: Ventronics 24-26 Kavanagh St, 81 3491

DSXpress Order Service Order with your Bankcard, Mastercard or Visacard. Just phone 008 22610 toll free for fast 24 hour despatch!

Enquiries: By mail, or phone (02)888 3200.

Order Value POST & \$ 500-\$ 999 \$50,00-\$99,99 \$2 00 \$6,00 **PACKING** \$10 00-\$24 99 \$3 50 \$100 or more **CHARGES**

Terms available to approved applicants \(\sum_{\text{Credit}}^{\text{Custom}} \)

SA Customers: Credit facilities available through C.C.C. 722 King William Street, Adelaide



P.O. Box 321, North Ryde, N.S.W. 2113. Tel: 888 3200

We've got the lot, at Rod Irving Electronics!*

Monitors, Modems, Printers, Cables, Cheap Disks, Drives, Cheap IC's, Storage Boxes, full range of Connectors, Joysticks, etc etc!



RITRON MULTI

PURPOSE MODEM
Our New RITRON Multi Purpose
Modem has arrived and has all the

- CCITT V21 300 Buad Full duplex
 CCITT V23 1200/75
 Bell 103 300 Full duplex
 Bell 202 1200 Half duplex

- Auto answer, auto disconnect.
 Telecom Approval No. C84/37/1134





- 300 baud Provides full 12V bipolar
- ouput signal Direct connect modem

(Phone not included)



\$180

TELECOMMUNICATION PLUG TO 2 SOCKETS.

Ideal for modem connections



425 High Street, NORTHCOTE, 3070 VICTORIA, AUSTRALIA Phone (03) 489 8866 TELEX: AA 38897 48-50 A'Beckett Street, MELBOURNE, 3000 VICTORIA, AUSTRALIA Ph. (03) 663 6151 Mail Order and correspondance: P.O. BOX 235 NORTHCOTE 3070

MAIL ORDER **HOT LINE**



(03) 481 1436

POSTAGE R	A	١٦	E	S		
\$1-\$9.99 .						\$2.00
\$10-\$24.99						\$3.00
\$25-\$49.99						\$4.00
\$50-\$99.99						\$5.00
\$100-199 .						\$7.50
\$200-\$499					1	10.00
\$500 plus					1	12.50
This is for ba	S	ic	F	0	S	age

only, Comet Road freight, bulky and fragile items will be charged at





This brand new, totally

amazing expansion unit for the Microbee is a must for all Microbee owners/users! Most expansion units up to this time offered at best only one or other features; and this made it impossible teatures; and this made it impossible to run, say, complex sound effects mingled with speech. The Enhancer 1 will do all this and much more as will do all this and much more as well. It is quite amazing how much has been shoe-horned into this compact unit. The Enhancer 1s' many powerful features inlcude:
 Two ATARI/COMMODORE/COLECO/SEARS type joystick inpute.

- inputs. Two TRS COLOR COMPUTER
- type joystick inputs.
 Allows the connection of Touch
 Pads, Paddles, Proportional
 Joysticks, Trakballs, Mice,
 temperature senors, lights level
 sensors, transducers, etc. etc!!
 A 4 voice music/sound effects
- sythesizer. A real time clock
- nited vocabulary speech
- synthesizer (option). Parallel printer interface (option) A built-in speaker with volume
- Listings of all necesary routines

- and logging. 5 digital input lines, 4 digital ouput
- A voice input channel
 A 40 pin experimenter socket with all 8 analog inputs, 5 digital inputs, 4 digital outputs, 3 58 MHz buffered clock, sound output iso that you can play the sound effects through your HIFI, 3 high resolution voltage comparators, DAC output etc.

 The amazing Microbe Enhancer is available exclusively from Rod Irving Electronics

 Cat.

 \$149



'IBM TYPE'

professional appearance with one of these "IBM type" casings, includes room for 2 5 1/4 inch disk drives and connection ports. Dimensions 49x39x5cm.

\$109 Cat X11090



MAINS MUFFLER

Sudden mains distrubances can senously affect your computer equipment, and stored data. Whys Muffler, particularly when the cost of one failure is likely to be greater than 59 euror and the cost of the cost of the cost of the Maximum total load.

Total load: 1000w 4 AMP 250v 50Hz age Single PI Section on - 150KHz - 40dB 500 KHz - 65dB 10 KHz - 80dB Stage Dual T Section

VDH Transient Suppression Surge capacity 2000 AMP 8x20 uS Cat X10090 \$249



GRAPHIC MOUSE SYSTEM

Now everybody can create superb computer graphics in minutes. Think of how much more professional your work could look with the 'Graphic Mouse! An absolute must for Apple Ile users. Includes software and

Cat. X17037 only \$99



APPLE* COMPATIBLE Printer Card Cat. X17029

Drive Card Cat. X17019 Speech Card Cat. X17031



APPLE JOYSTICKS

Ideal for games or word processing. Fits most 6502 "compatible" computers.

\$27.95 Cat. C14200



APPLE* COMPATIBLE SLIMLINE DISK DRIVES

\$220

s a registered trade mark



REPLACEMENT KEYBOARDS

- For Apple 42 single key BASIC command
- One chip custom design encoder Made by ALPS, life time.
- 10 million operations

 Dimension: L340xW110xH42m



- - nillion operations ension: L340xW130xH42mm

Cat. KC2002



IBM* COMPATIBLE COMPUTER \$2,450



M2896-63

MZ690-03 Slimline 8" Disk Drive, Double sided Density No AC power required. 3ms track to track, 1.6 Mbytes unformatted, 77 track side 10s/su10 bit soft error rate.

\$550 Cat. C11916 Case & Power Supply to suit Cat. X11022 M2894 Standard size 8" drive. Double

Cat. C11914 Case & Power Supply to suit \$630 Cat. X11011

M4854
Silmline 51/4" disk drive. Double sided, double density, 96 track/inch, 9621 bit/inch, 1.6Mbyte unformatted 3ms track to track access, 77 track/side.

Cat. C11904 Case & Power Supply to suit. \$350 Cat. X11011

M4853
Slimline 51/4" disk drive, Double sided, double density, 1 Mbyte unformatted, 3ms track to track, 80 track/side, 5922 bits/inch. Cat. C11903

M4851 Slimline 5¹/4" disk drive. Double sided, double density 500K unformatted, 40 track/side. Steel band drive system

Cat. C11901 Case & Power Supply to suit Cat. X11011

M4855 Slimline 51/4" disk drive, double sided, double density, 96 track/inch. 2.0 Mbytes unformatted.

Cat. C11905 MF351

Standard size disk drive Cat. C11921



RITRON 2

available in amber or green

1-9

10+

Green Cat. X14500 100 + \$205 \$215

Cat X14500



PHOENIX 5

- al and R G B
- 13" CRT Dot Pitch 0 65mm
- Horiz Resol 320 TV lines Vert Resol 560 TV lines Display Characters 1 000 Ch (40x25)
- Green text display \$499

PHOENIX 4

- High Resolution
 Tai CRT Dot Pitch 0 31mm
- Horiz Resolution 720 dots
 Vert. Resolution 240 T V L
 Display Characters 2000
 Ch (80 x 25)
 R Display colours and ottors



IC SPECIALS!

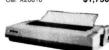
1-9 \$1.80 \$3.25 \$5.90 \$6.25 \$8.25 \$12.50 \$1.70 \$2.95 \$5.50 \$5.95 \$7.95 \$11.50



IBM ADD ON HARD DISK

eagate hard disk

Hard disk controller by Xebec



RITEMAN INFO RUNNER

An exciting new printer from the experts "Riteman". This compact stylish printer performs like printers twice its price and size. 120 C.P.S.



MB100S
The next generation of "80" type printers. 100 CPS, internal buffer expandable to 4K, Greek as well as italics. The print quality is the same as its forerunner. Square pins and film ribbon make it unbeatable.

\$329



Juki Printer Professional daisy wheel printer 18CPS full incremental mode Diablo 630 emulation. Large range of daisy WAS \$790 NOW \$725



FULL RANGE OF **ITOH PRINTERS**

8510 SP 180 C.P.S tax exempt \$773 incl tax \$928 tax exempt \$1,000 incl. tax \$1,167 8510 SC (Colour) tax exempt \$906 incl tax \$1,057



READY MADE CABLES

Cat. P19011 \$23 95



DISKS GALORE!!

SPECIALS!

Head Cleaners

VALUELIFE C12421 S/S D/D C12425 D/S D/D

Verbatim 12801 F032-8000 SS D D 12803 F034-1000 SS D D 12803 F034-1000 SS D D 12804 F034-8000 SS D D 12804 F034-8000 SS D D 12806 F010-4008 D S S D 12806 F010-4015 D S S D 12807 F010-4026 D S S D 12808 FF32-2000 S D D D 12809 FF34-2000 S D D D 12810 D032-4000 D S D D 12811 D034-4001 D S D D 12811 D034-4001 D S D D

2812 DD34-4008 D/S D/D 2813 DD34-4015 D/S D/D C12814 DD34-4026 D/S D/D 51/4" Verbatim Disks

\$39.50 (S/S D/D 10 Sect. 40 Track) C12502 MD550-01 \$39.50 C12504 \$49.50 10 Sect 40 Track) C12505 MD550-16 **\$49.50** S D/D 16 Sect 40 Track) C12506 MD577-10 \$59.50 (S/S D/D 10 Sect 80 Track) C12508 MD577-16 \$59.50 (S/S D/D 16 Sect 80 Track) C12509 MD557-01 \$59.50 (D/S D/D Soft Sect 80 Track) C12510



XIDEX DISKS

Box of 10 S.S. D.D. Cat. C12401 \$34.50 \$29.50 Box of 10 D.S. D.D. Cat. C12410



DISK STORAGE BOXES Efficient and practical, these disk storage boxes protect your disks from being damaged or lost.

50's.Features smoked plastic cover with provision for a lock. High impact ABS plastic base

Cat. C16050 \$34.50

Cat C16025 \$26.50 50's Features smoked plastic cover Divided into 10 sections, each fan elevates the disks for easy identification and access.



for use

An impressive demonstration
program package
Compatible to all Microbees
All units carry a 90 day warranty
and servicing is also available
Digital recording and playback of
speech and sound

An 8 channel analog to digital
converter with variable voltage or
variable resistance type analog
inputs and also user selectable
resolution from 1 to 9 bits
A digital to analog converter with

A digital to analog converter with selctable resolution from 1-8 bits
 Allows automatic data acquisition

oice input channel

COMPUTER CASING

Second Stage Dual T Section 150KHz - 20dB 500 KHz - 60dB 10 KHz - 70dB 1

For Apple 45 built in function keys, BASIC and CP/M command. 45 user defined keys Built-in shift lock Made by ALPS, life time, 10 million operations

Including Tax!

Cat X14520

\$849

Cat. P19013

'If not, then very nearly!

Direct sound broadcast satellites

Talk of satellite transmission usually sets us thinking of TV and the telephone, but a conference in Geneva this August hopes to pave the way for direct sound broadcasting with radio transmissions by the 1990s.

On 8 August several hundred delegates will meet for some five and a half weeks in Geneva for a World Administrative Radio Conference (WARC) that will plan what is to become of the world's satellites. If the conference succeeds, a further conference in 1988 may allocate some frequencies for the operation of sound broadcasting in space, from satellites. The plan is to look at the area of 12000 MHz or 12 GHz, and it is expected that the mass production of receivers to cover this band would be no more expensive than those marketed for medium and shortwave.

The low cost direct transmission through satellites would enable many underdeveloped countries, which can now serve only some 20% of the population through standard medium and shortwave broadcasting, to increase coverage through community listening to satellite broadcasting. Three research scientists at the European Space Agency Headquarters in the Netherlands recently published a proposal which they feel should be seriously considered, as planning for direct broadcasting is at a crucial stage.

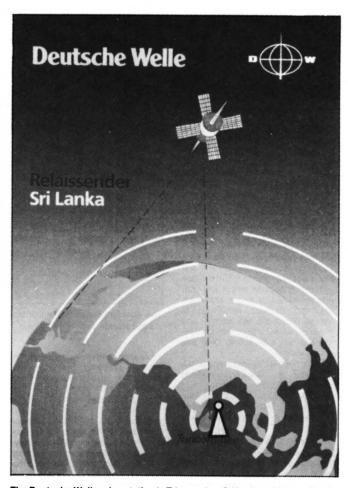
Direct broadcasting with radio transmissions via satellite would mean that up to 16 or even 20 radio programmes could be distributed by a satellite which can only accommodate one television programme; hence variety is increased and the cost reduced when the satellite is used to relay radio broadcasts.

The West German government is planning direct broadcasts from satellites next year but this would be to a very select audience who would have to have special receivers. The quality of the transmission is comparable to a compact disc and will certainly be appreciated by those who demand excellent reproduction of music. The USSR is using a band below 1 GHz but the European Space Agency scientists believe that this can never reach the quality or the number of programmes which could be sent when using a higher frequency.

The technical aspect of satellite transmission is being investigated, particularly regarding the receiver and aerial, and it could be that the dish would eventually be replaced by a rod aerial on the receiver. The receiver would be very sensitive, which would increase the signal. But on the other hand unwanted noise such as automobile interference would increase, so a development to reject the unwanted noise would have to be part of the new receiver.

Although the German system is planned for introduction next year, scientists feel that this is optimistic and it could be 1987 or 1988 before it comes into operation. In the meantime, pressure will be on manufacturers of receivers and also on researchers to invent new kinds of portable receivers, though these may not be commercially available until the 1990s.

It is obvious that international



The Deutsche Welle relay station in Trincomalee, Sri Lanka, which receives its programmes by satellite from the studio of Deutsche Welle in Cologne. This verification card shows the link between studio and transmitter.

broadcasters would be interested in direct transmission into the home because of the difficulties of propagation on shortwave. The share of facilities between countries could well overcome the cost factor of satellite transmission. One problem which could occur with joint operation is that programmes covering political matters may be critical of another country using the same satellite, and it is felt that an international body would have to be created to ensure that all programmes carried were not of any controversial nature. However, there seems to be a lack of urgency in this type of operation, mainly because it is felt that the market is not yet

ready for direct broadcasting via satellite.

Nevertheless, in a recent discussion on Media Network broadcast by Radio Netherland. Jonathon Mark interviewed a Professor of Telecommunications at the Eindhoven University of Technology who discussed work on the new type of radio receiver transmission. Officials from Philips and Telefunkun have expressed interest in the marketing of these new receivers, and are aware of the high quality reproduction which could be made available to listeners worldwide using this new broadcasting technique.

- Arthur Cushen

KILOHERTZ COMMENT

AUSTRIAN MAIL: Austrian Radio has released figures of its mail count for the M transmission period (March-May 1984) and this shows a considerable number of letters and reports from the South Pacific. Mail from Australia totalled 978. New Zealand 482, Papua New Guinea 13 and Vanuatu 27. The total mail received for the two months was 20,587 from 89 countries. The station also received numerous recordings on cassette from listeners, and commented that a technical evaluation of the recordings gave the station a summary of the receiving conditions in the various target areas and on the different frequencies. The Austrian Radio commented that the receipt of cassette recordings gave the station direct contact with its listeners and that it was able also to return the tape with some Austrian music and confirm the reception. Some 129 listeners sent cassette recordings to Vienna during the two months, and these came from 30 countries. Verifications are issued from DRF and should include:

Date, time (UTD), frequency (kHz).
 Type of receiver, receiving antenna.

Reports should be sent to the Austrian Radio, Technical Department, PO Box 200, A-1043 Vienna, Austria.

LIBYAN REQUEST: In a recent letter the director of Radio Jamaheriya, Mohammed Sweidan, requested



The Austrian Radio transmitter buildings with well known technical director, Herbert Kunhle, in the foreground.

more reports on its radio signal. The station presently transmits two broadcasts on the shortwave band. One is on 11815 kHz between 2230 hours and 2400 hours UTC. The African service of Radio Jamaheriya broadcasts on 15450 kHz between 1800 and 1900 hours UTC. The station would particularly like to receive reports on the 11815 kHz frequency. It is interested in technical informa-

tion, such as the SINPO rating, and remarks about modulations, interference (if any) and signal strength, but would also welcome comments or suggestions on the contents of its programmes. Any reports received will be QSLed. Programme schedules and other information are available on request. The address is Radio Jamaheriya, PO Box 17, Hamrun, Malta, Europe.

VATICAN'S "FOUR VOICES": Vatican Radio's "Four Voices" programme was set up 10 years ago, during the 1975 Holy Year. It was intended as a service for pilgrims to inform them about the daily Jubilee activities, to indicate religious and cultural events in Rome, and to give them brief information on road conditions, the weather and exchange rates, as well as international news.

"Four Voices" was so popular that it was decided to continue it after the closing of the Holy Year as Vatican Radio's general information programme. With the exception of Sundays and other holidays "Four Voices" now goes on the air three times a day (0700, 1130 and 1600 UTC) for a total broadcasting time of two hours in four languages: Italian, French, English and Spanish. The morning transmission consists of 10 minutes of international news in each of the four languages followed by a slot of reports and interviews. The broadcasts at 0700 are heard on 9645 and 11740 kHz. Radio's daily transmissions to Australia are at 2205-2220 UTC on 6015. 9615 and 11830 kHz, and again at 0200-0215 UTC on 7125, 9650 and 11865 kHz.

This item was contributed by Arthur Cushen, 212 Earn St, Invercargill, New Zealand, who would be pleased to supply additional information on medium and shortwave listening. All items quoted are UTC (GMT) 10 hours behind Sydney time, all frequencies are in kilohertz (kHz).

DOC news

Regional radio and television audiences will have greater access to local programming including news, sporting highlights and advertising for local businesses following Government changes to legislation. In the past individual licencees have been required to broadcast without alteration the same program over their main station and any subsidiary transmitter in their service area. Amendments to the Broadcasting and Television Act 1942 will enable commercial radio and television licencees to develop more local programming on subsidiary transmitters.

The Minister for Communications, Mr Duffy, said the government was also amending the *B & T Act* to provide for **short-term broadcasting permits** of up to 28 days. Examples of such temporary services would include ones that had a substantial

connection with a special event, say, a festival or a jamboree, or that would provide information and support services to communities after a disaster or an emergency.

In another change the Government plans to empower the Australian Broadcasting Tribunal to grant permits, initially for up to five years, for **broadcasting information services**. These services could be operated by commercial enterprises such as leisure resorts and tourist attractions, and cater for the specialized information needs of people enjoying those facilities, Mr Duffy said.

By the end of 1986 Australia's multicultural television network SBS-TV will be operating nationally in all capital cities as well as in the regional centres of Newcastle, Wollongong, Goulburn and Cooma.

The next expansion will be to

Perth and Hobart in January 1986, and Darwin will follow before the end of 1986. Programs will originate from the SBS headquarters in Sydney and be distributed to the three cities via the Aussat satellite system.

In Darwin a temporary mast will be erected in Blake Street to carry UHF transmitting antennas until a replacement tower can be built. SBS-TV will operate on UHF channel 28 in Darwin and later there will be a new commercial station, which will also operate on a UHF channel.

A new satellite receiving earth station on Mt Wellington for Hobart is being tested this winter to check its operating performance in extreme climatic conditions and minor adjustments should be completed before full-time broadcasts beign early next year.

SBS-TV programs in Perth will be received at AUSSAT's Major City Earth Station and transmitted from Mt Bickley to households in the Perth area.

The Department of Communications has issued a warning that people thinking of buying UHF television antennas should ensure they obtain the correct type for their area. A spokesperson said that to obtain clear reception of stations using UHF Channels 28 to 35 a Band IV UHF antenna was required, while the smaller Band V antenna was suitable for reception of stations operating on Channels 39 to 69.

Most of the main SBS stations will transmit on Channel 28, requiring a Band IV antenna. The Department says to be wary about buying an antenna that is sold merely as a 'UHF antenna', unless a guarantee can be obtained as to whether it is Band IV or Band V.

Pamphlets with UHF reception details are available from DOC local offices.

Modular meter

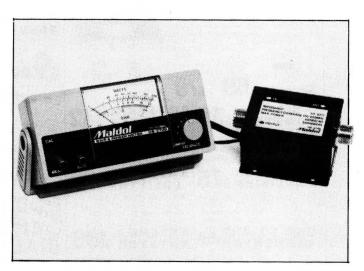
A new Japanese-manufactured VHF-UHF SWR-power meter has recently become available through GFS Electronic Imports. Called the HS-370S it covers a frequency range of 130 to 450 MHz with extended operation outside this band at reduced accuracy.

The design of the meter incorporates modular construction, with the directional coupler separated from the main meter unit. Each of these sections has its own mounting brackets and the cable that connects them is 1.6 metres long, allowing for wide separation and providing the convenience of not having to bring heavy coax cables up to

the indicator. The indicator is 130 x 62 x 38 mm and the coupler is 70 x 60 x 35 mm.

Power measurement ranges are 0 to 20 watts and 0 to 200 watts, while the SWR range indicates 1:1 through to 3:1. Insertion loss of the directional coupler is less than 0.5 dB. For night-time operation the meter scale can be illuminated by the connection of a 12 volt power source.

The HS-370S is \$90 RRP plus \$6 freight. For further information contact GFS Electronic Imports, 17 McKeon Road, Mitcham Vic 3132. (03)873-3777. Telex 38053 GFS.



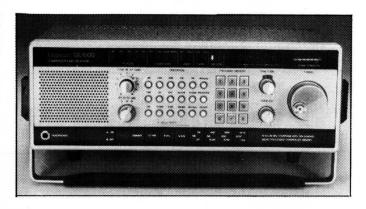
Bearcat receiver

Dick Smith Electronics has announced the release of a new communications receiver, the Bearcat DX1000, capable of reception down to 10 kHz.

Featuring microprocessor controlled digital technology, the DX1000 covers 10 kHz to 30 MHz continuously with PLL synthesized accuracy. It has 10 memory channels to allow for instant recall or faster 'bandscanning' during key openings. The digital display measures fre-

quencies to 1 kHz or at the touch of a button doubles as a two time zone, 24 hour digital quartz clock.

The receiver can be programmed to activate peripheral equipment. It can record up to five different broadcasts on any frequency and using any mode, and also includes IF bandwidth selection to help to separate high powered stations on adjacent frequencies.



Albanian broadcaster

Listening to the anti-American, anti-Russian and anti-Chinese broadcasts on Albanian radio, one gains the impression that this country bordering the Adriatic has no friends.

With a population of 2.8 million, Albania has one of the world's biggest shortwave services with 582 hours of programming each week. This figure is twice the weekly broadcasts of Radio Netherland and many of the other well known international broadcasters. But the broadcasts are dull as they come from a country which seems to live in complete isolation. Indeed, many major broadcasters such as the BBC and Radio France International no longer

broadcast in Albanian, although Voice of America, Radio Moscow and Radio Beijing continue with their programmes for Albania, as do many gospel stations.

Since 10 January 1946 when Albania declared itself a communist people's republic, not many foreigners have visited the country. A direct flight from Vienna is one of the few ways of arriving at the capital Tirana, but for men, long hair is not in favour and could be cut by the airport barber, and women should dress in plain clothes.

Radio Netherland recently reviewed a new book written by a West German who visited Albania, mainly to look at Radio Tirana. Photos of the broadcast-

ing building were not allowed, according to an armed guard, though the verification card from Radio Tirana shows a picture of this building. The German visitor had an eventful time trying to meet someone on the staff at Radio Tirana to talk about the broadcasts and found that the studios were far from modern. The foreign language broadcasters on Radio Tirana do not disclose their names; they prefer to remain anonymous to avoid trouble if they decide to return to their own countries some time in the future. Tourists in Tirana can hear the Foreign Service which is broadcast on shortwave and also carried on FM, so that at some time of the

— Arthur Cushen

day a programme in English, German and French is available.

Listeners in Australia are aware of the broadcasts of Radio Tirana which has programmes to this area in English at 0700-0730 UTC on 9500 and 11985 kHz, and again at 0930-1000 UTC on 9500 and 11950 kHz, while the third broadcast beamed to Australia is at 1400-1430 UTC on 9500 and 11985 kHz. There are 16 halfhour broadcasts in English each day from Radio Tirana, and as well there is a shortwave relay of the local programmes on 5020 and 5027 kHz. The station confirms reception reports and has the simple address of Radio Tirana, Tirana, Albania.



FIX IT EASILY: TRY ONE OF OUR NEW PICTURE FIXERS FOR IMPROVED PERFORMANCE ON UHF/VHF/FM BANDS. Specifically designed for Australian Standards and TV channels hese superb new signal boosters are just a small part of ou luge range of TV and VIDEO ACCESSORIES. SAE for further info these superb new signal

MASTHEAD AMPLIFIERS



24dB UHF Gain: **\$69**

24dB UHF Gain: 22dB



BOOSTER \$39

GAIN: 10dB. Reduces loss from splitters and long cable runs. Inline coaxial amplifier, 5 to 950MHz, 12vDC or mains power.

AMPLIFIER \$75

GAIN: VHF 26dB, UHF 24dB, coax 75 ohm in, 75 ohm out. Hi gain indoorsignal amplifier, metal shielded box, 240v mains power

UHF TO VHF 69

Convert UHF signal to VHF, CHI 3.4 selectable, ideal for UHF VCR'S to use VHF TV set built-in amplifier ensures no signal loss. 12vDC or mains power.

BOOSTER/ SPLITTER \$32

GAIN: 6dB. 75 ohm in, 2x75 ohm outputs, for indoor or ceiling aerials, reduce loss from long cables, 12x0C or mains power.

AMPLIFIED SPLITTER \$79

GAIN: 12dB 75 ohm in, 4x75 ohm outputs with new variable gain control, for TV or VCR etc 12v DC or mains power.

ANTENNA ROTATOR \$109

Fully automatic fully approved by Energy Authority, suits VHF and UHF aerials, FM and small and UHF aerials, FM and small HF aerials up to 50Kg vertical load. Rotates 360, in 70 secs.

PACK/POST: \$2 plus 5: Order Value, 33¢ stamp for further info

STEREO MAGNETIC CARTRIDGE REPLACEMENT

Cheaper than most stylii alone! Latest model moving coil system, 15Hz-35KHz freq.response 2.5mV output, 0.6mm Diamond stylus, tracking force 2 grams, standard }" mtg with mtg kit

VARIABLE TV SIGNAL 20dB **ATTENUATOR**

ts out signal overload, variable from 0-20dB. \$9.99 0-20dB. [] 75 ohm coax



ONLY

36 PINPARALLEL PRINTER ON PLUGS

36 way, gold-plated pins,

genuine USA made plugs. FACH LIMITED QTY

Merow DIGITAL

EACH \$ 9.95

PUSH-BUTTON WITH MEMORY DIRECT REPLACEMENT FOR STANDARD ROTARY TYPE -ASTLY FITTED IN MINS

STEREO BOX PHONES SALE Not \$19:95 PAIRS FOR **≤** 89. **€** PARTLY WATER-DAMAGED STOCK

Should be 1 or 2prs working! EACH LM3900 **39¢** WERE 50¢ 29¢ RCA 3401 EQUIVALENT SUPPLIED!

C106 SCR 50V 4A ea **32¢** 10-99 **29¢** Used Centonics 703 printer with spares 160 CPS only...\$450

Computer S100 system Z80 CPU 64K Dynamic ram, 2x 8" SSDD disk drives and controller \$550 8" drives only \$300 Used Centonics 703

620mm

350mm

ULTRASONIC 🖪 CAR ALARM with radio key

Keyless digital radio control transmitter for arming/disarming, transmitter for arming/acisarming, current door sensing AND ultrasoni detectors, panic alarm button, LED status indicator, inbuilt siren, l minute exit delay, auto reset, easy installation instructions.



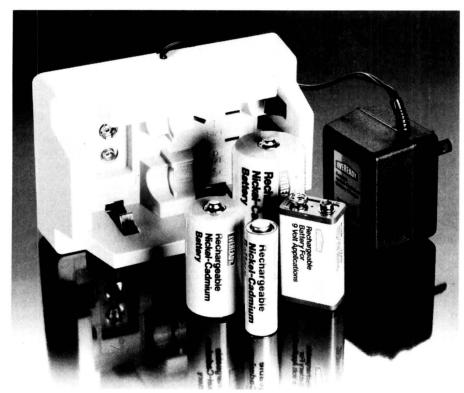
1N5404 400PIV 3AMP 10 for

PRE-PAK electronics p/l

1a WEST ST, LEWISHAM, NSW 24 HR PHONE ORDER SERVICE

Phone or mail order **BANKCARD** accepted

Plug into 'Eveready' rechargeables.



Our rechargeable range, in popular sizes, can be charged up to 1000 times on the new model ACC50E Charger, thus offering an extremely economical power source to the heavy-battery user. Especially ideal for photo-flash, movie cameras, tape recorders, transceivers and electronic games and toys.

Please don't hesitate to call for further information.

EVEREADY

Rechargeable Nickel-Cadmium Batteries.

Union Carbide Australia Limited, Battery Products Division, 30/40 Harcourt Pde, Rosebery, Phone 667 0444. SALES OFFICES: Sydney: Cnr Hayes Rd & Dunning Ave, Rosebery. Phone 693 2666. Brisbane: 47-49 Sherwood Rd, Toowong. Phone 371 6877. Adelaide: 121 Greenhill Rd, Unley Phone 2720611. Melbourne: 14 Queens Rd. Phone 26 1241, 26 2332. Perth: 31 Outram St, West Perth. Phone 321 2926

UNION CARBIDE

ady and 'Union Carbide' are registered trade marks.

WIRELESS INSTITUTE OF AUSTRALIA

FOUNDED 1910
The W.I.A. represents the
Radio Amateur at Local,
National and International

level and offers AMATEUR RADIO following services:

- ★ Monthly "AMATEUR RADIO" Magazine, included in membership fee
- ★ Most REPEATERS have their licence, power and site cost paid by the institute.
- ★ World wide QSL-service.
- ★ Assistance to members in legal problems arising out of the pursuit of their hobby.
- ★ A Weekly Sunday Broadcast to Amateurs and Short Wave Listeners.
- ★ Assistance in dealing with Interference Problems (TVI-RFI etc.)
- ★ Novice and full call courses.
- ★ Trial Novice and AOCP theory exam papers.
- ★ Advice on Radio Mast approvals
- ★ The ONLY representation of the RADIO AMATEUR in legislative matters.





Join the 8,600 Amateur members in the W.I.A. by forwarding this coupon to: W.I.A. P.O. BOX 300,

CAULFIELD SOUTH, VIC. 3162

Please forward a membership application form and further details to:

Mr,	Mrs,	Miss,	Ms	 							•

Address	 				•		 								 		

Callsign	 	 	

Postcode

lan J. Truscott's

ELECTRONIC WORLD

MORE & MORE

People are discovering us each week. Both the home enthusiast through to the small manufacturer.

COMPONENTS • TOOLS • KITS

In any quantity, buy one, or one thousand, we're happy to oblige

SCHOOLS • CLUBS ETC.

Inquire about our bulk discount deals

Save yourself a trip to the city - come to

30 LACEY STREET CROYDON

OR PHONE

(03) 723 3860/ 723 3094

Mail orders welcome

MAIL ORDER SPECIALS

* PHILIPS

Ultrasonic car alarms \$129 **\$85**



* PRO-2

F.M. Lapel mike. \$25 **\$21**

* ZN414

One chip radio \$4.35 **\$2.50**

* All JEKNIKA

Replacement stylii 15% off

Post & Pack: \$10 or less-\$1.50 \$10 + -\$3.00

AUSTRALIAN ELECTRONIC COMPONENTS

Shop 2, 60-64 Railway Rd. Blackburn

Phone: (03) 878 9724







NEXT MONTH: SPECIAL BONUS OFFER!

t miss the July you not one, packa gether Ications ₫

way a copy of one llong With Ш lectron

How's that for value?

COMPULSIVE PROGRAMMERS

— an alternative view

Just finished fifteen hours in front of the computer? Eyes feel like roadmaps? Well, get yourself a glass of something strong, curl up somewhere quiet, and consider this . . .

DESPITE THE MUCH-LAUDED benefits flowing from computers and information technology there are fears that all is not well for the computer user.

There is growing concern amongst some educationalists and academics that excessive use of computers can create social and psychological problems, especially in the young. It is thought that social development may be inhibited, relationships damaged, and that academic achievement may be adversely affected.

Has society created and encouraged this new compulsion? From every side, via every medium, we are being indoctrinated with the idea that we will have to be able to program computers if we are to survive and cope in our brave new world. Those who are unable will be seen as technological illiterates.

In order to program effectively one must spend vast amounts of time at the keyboard. The concepts involved in writing the simplest program are quite considerable for the naive user. Many never go beyond this stage and confine themselves to using commercial software prepared by those more skilled. Some may never return at all and remain suspicious of this awe-inspiring equipment.

However, others do continue and can become highly involved and skilled; they can also get hooked by the activity and become compulsive programmers. They are more interested in the *process* of programming than in the result of their work.

Who's hooked?

Research currently taking place at Loughborough University, in England by

Margaret Shotton aims to investigate the incidence of this modern phenomenon and determine its causes and effects. After extensive media requests people contacted Margaret about their 'compulsive programming'. The phenomenon was obviously very real for some people.

The initial survey showed that the vast majority (over 97%) of those hooked were male. Many were spending up to 40 hours per week of their spare time at the computer. One could see that there would be little time for other activities in their lives, assuming the human body still needed time for sleep.

Why is this pastime predominantly confined to men? There are many theories that need investigation.

1. Men are generally more obsessive about their hobbies in general; golf and fishing widows are not uncommon.

2. Men are able to devote hours and hours of their spare time to one particular hobby, whereas women have more demands made upon them by their families etc. This argument loses force when one considers that this sex difference in computer 'addicts' occurs in the young and the single.

3. Computer advertising is geared to the business world. But once again there are probably far more women in business and clerical tasks who would benefit from the new technology and should welcome it.

4. Arcade and computer games, often the initial means of contact with new technology, are geared to the male as aggressor and hold little interest for females. There has to be something in this as the computer indus-

try is pouring money into designing games especially for girls, but with very little success.

5. Women are not mechanically-minded and are suspicious of machines (a well-worn adage). Take a look in any woman's kitchen to see this is not so. She probably deals effectively with far more machines each day than most men. True, she may not repair them, but she positively encourages their purchase to ease her day.

6. Women are illogical and disorganized thinkers and cannot cope with the demands of computing. Discussions with the computer industry have revealed that many prefer to employ female programmers, if they can find them, because they tend to be more methodical, practical and efficient.

7. Fewer girls take computer studies courses and are therefore less likely to get into the area. Discussions with teachers have revealed that not only are the majority of computer teachers male and courses geared to male interests, but also that curriculum organization often places computer studies in competition with History, French or even Home Economics, which are all traditionally very popular choices for girls. It is hardly surprising that the computer option is rarely taken up.

In primary schools these sex differences do not seem to occur. Here computers are used mainly as carriers of educational software and usually no bias is observed between the boys' and girls' enthusiasm for computers. In secondary schools, however, computing tends to be taught as a subject in its own right, rather than used as a tool. This is probably a most relevant aspect.



Margaret A. Shotton

8. Women see very little need for a home computer. This statement is supported by the opinions of many women. They cannot see how it will aid their work in the home, and often resent the financial outlay which they feel could be put to better use. The excuse that it can be used for keeping household accounts, when previously the back of an envelope has sufficed, carries little weight with many women.

The damage done

One may wonder how anything so intrinsically fascinating can do any harm. Problems start when an interest becomes an obsession.

A typically obsessed schoolboy will spend every break time in the computer room with little thought for making friends, let alone lunch. At home all his spare time will be spent in his bedroom on the micro. Small boys, not normally renowned for early rising, report waking up at six o'clock in the morning to play games.

Most parents positively encourage their children to use computers initially, as it keeps them occupied and can only be of benefit to their futures. However, when children start refusing to participate in family outings or to come to the meal table, problems can occur. Interactions with their peers may become very limited because of the lack of common interests, and isolation tends to follow. This may drive the child to depend more heavily upon the computer where rewards are fast and fun, and mistakes private, impartial and non-judgmental.

Experience has shown that young hackers

often make poor students, and some university computer departments are now trying to recognize and eliminate them at the interview stage. Others become hooked while at university. Lectures are skipped, course work goes to the wall and many fail their degrees, despite their high levels of intelligence.

Another group which appears to have a great affinity for the computer is married men. Pressures from work or the threat of unemployment convince them that computer literacy is the only way to succeed. There are reports from America that divorces are occurring because of the compulsive behaviour of some husbands: husbands who have changed from lovable, sociable beings into recluses.

Research so far carried out at Loughborough has revealed that there seems to be two different types of men who get hooked by computing. One group may be termed the workaholics. They may either be bringing their office work home with them or they may be writing software in order to sell it. Money, promotion or prestige are their aims and they rarely program for the sake of it. Despite the vast number of hours that they spend, there is always an end product in mind.

The second group appears to be those who in the past have always been obsessive about a hobby to some degree. Computer

programming has become the ultimate pastime.

Do the majority of men, who have at some time had some degree of obsession about a hobby, have *great* difficulty with human relationships? These men usually report that from an early age, they have had great difficulties with human relationships. The computer is refuge.

At last they can interact with something which totally accepts them, offers them continual intellectual challenge and an escape from reality. They report that they prefer this interaction to that with humans.

Still, the computer is not something to fear. Very, very few people get hooked in the way described. To some, with little desire for social interaction, the computer is a boon. It may even increase one's status in the eyes of one's peers, who may see the junky as the computing guru and the fount of all knowledge. Also networking, like CB radio, gives the shy an opportunity to communicate with others without the trauma of face-to-face encounters.

There is much still to be investigated. Margaret would be pleased to hear your opinions and experiences on this subject. (All information will be treated confidentially.)

Please write to: M. A. Shotton, Dept. of Human Sciences, Loughborough University, Leics. LE11 3TU, England.

Circuit-Board-Design Without the Tedium

smARTWORK™ lets the design engineer create and revise printed-circuit-board artwork on the IBM Personal Computer.

Forget tape. Forget ruling. Forget waiting for a technician, draftsman, or the CAD department to get to your project. smARTWORK™ software turns your IBM Personal Computer into a professional, high-quality drafting tool, It gives you complete control over your circuit-board artwork–from start to finish.

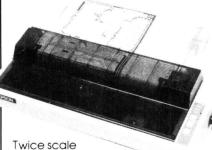


smARTWORK™ transforms your IBM PC into a CAD system for printed-circuit-board artwork. Display modes include both single-layer black and white and dual-layer color.

What makes smARTWORK™ so smart is that it understands electrical connections.
Conductor spacing is always correct, lines don't become too narrow, and connecting lines do not intersect other conductors. smARTWORK™ can automatically find and draw the shortest route between two conductors.
Or you can specify the route.

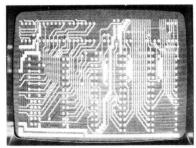
smARTWORK[™] is the only low-cost printed-circuit-board artwork editor with all these important advantages:

- Complete interactive control over placement and routing
- ☐ Quick correction and revision
- ☐ Production-quality 2X artwork from pen-and-ink plotter
- ☐ Prototype-quality 2X artwork from dot-matrix printer
- Easy to learn and operate, yet capable of sophisticated layouts
- □ Single-sided and doublesided printed-circuit boards up to 10 x 16 inches
 - ☐ Multicolor or black-andwhite display
 - 32 user selectable color combinations; coincident
 points can be displayed in contrasting colors.
 - ☐ Can use optional Micro-soft Mouse as pointing device.



Twice scale hardcopy of your artwork is produced using the Epson dot-matrix printers or the Houston instrument DMP-42 pen-and-ink plotter. Quick 1X check plot is also available from Epson printers.

""smARTWORK" and "Wintek" are trademarks of Wintek Corporation.



Dual-layer color display of a 2" by 4" section of a 10" by 16" circuit board

The Smart Buy

smARTWORK™ is exceptional value, particularly when compared to conventional engineering workstation costs.

Call or write to us for more information on smARTWORK™. We'll be glad to tell you how smARTWORK™ helps us design our own circuit boards and what it can do for your business.

System Requirements

- □ IBM PC, XT or close compatible with 192K RAM, 2 disk drives and DOS Version 2.0 or later.
- ☐ IBM Color/Graphics Adaptor with RGB color or B&W monitor.
- ☐ Epson MX80/MX100 or FX80/FX100 dot matrix printer or compatible with Graftrax.
- ☐ Houston Instrument DMP-42 pen-and-ink plotter (preferred). Small Houstons and HP7475A also supported.
- ☐ Microsoft Mouse (Optional).





SHOP AROUND

FOR SALE: COLLECTION of antique radios, valves and parts for sale. Prefer to sell the lot.

M. Gistinger, 41 Willmington St, Newmarket, 4051.

FOR SALE: BRAND NEW and used semiconductors, ICs — linear and TTL and CMOS logic, resistors, capacitors, electrolytics, power transformers, mixed components etc. Ideal for electronics constructors of all types. Ph. (03)874-2770.

FOR SALE: TRS80M3 COMPATIBLE, 64K DRAM, two SSDD 51/4" drives, sep keyboard, wirewrapped on Eurocards; hi-res amber monitor, DOSs, wordprocessor, BASIC; games, manuals. \$950 ono. Neil (053)67-1480.

FOR SALE: MICROBEE TAPE COPIER. Make back-up copies of M/C programs at 300 or 1200. Allows code modification. \$10 incl. postage. J. Arnold (02)625-8950.

FOR SALE: APPLE SUPER SERIAL CARD. Premium RS232C printer or modem interface for Apple II, IIe. 50 to 19.2 kilobaud. \$185. Phone (089)52-3692 ah.

FOR SALE: COMMODORE 64. Large variety of software available. For further information contact D. Hamilton, 32 Miro St, Young, NSW 2594.

FOR SALE: SEIMENS 100 teleprinter spare parts, available at low cost. Post anywhere. Send SSAE for details. Frank Rees, 27 King St, Boort, Vic 3537.

FOR SALE: VZ200 and VZ300 software, tape and disk. Educational, games business and M/L units. Ext. BASIC with disk commands. SASE J. D'Alton, 39 Agnes St, Toowong, Qld 4066. (07)371-3707.

Of our three projects this week the ETI-679 Microbee joystick adaptor should provide the least trouble. Get the bits at the corner store. If you have any trouble phone engineer Geoff Nicholls and tell him your troubles.

ETI-743: The UHF amplifier was designed from a circuit developed by Dick Smith Electronics. DSE will stock kits for around \$129. You will notice that we have specified a hybrid, the Motorola MHW-710 for this circuit. This is the first time we have used such a device for many years. A nice counterpoint to our article on hybrids et al in this issue. Apparently, many of the other hybrid manufacturers are producing equivalent circuits, so if you don't want to deal with DSE, you might like to try them. The cost of an MHW-710 from DSE is about \$20. At the time of going to press all electronic components had advised that it would be making up the kits, also for \$129.

The tape auto search project, ETI-693, involves a whole bunch of common as mud components that should be available anywhere. None of the semis are particularly critical; if you can get an equivalent, by all means use it. Most of the common kit suppliers will be supplying it in kit form. Expect to pay in the vicinity of \$30 to \$40.

Artwork

Making your own, here are the prices for this month's projects: ETI-743 pcb \$7.50 panel \$2.70; ETI-679 pcb \$1.50; ETI-693 \$1.85 panel \$2.85. Make cheques or money orders payable to 'ETI Artwork Sales'.

Boards and panels

Front panels and pc boards for our projects may be obtained from the following suppliers:

All Electronic Components 118 Lonsdale St Melbourne Vic 3000 (03)662-3506

RCS Radio 651 Forest Rd Bexley NSW 2207 (02)587-3491

Jemal PO Box 168 Victoria Park WA 6100 (09)451-8726

Mini Tech PO Box 9194 Auckland NZ

For pc boards produced in recent years, the following suppliers either keep stocks on hand or can supply to order:

Acetronics 112 Robertson Rd Bass Hill NSW 2197 (02)645-1241

Jaetronics 58 Appian Drive St Albans Vic 3021

Jaycar 117 York St Sydney NSW 2000

Rod Irving Electronics 425 High St Northcote Vic 3070

QUALITY FROM ENGLAND



AUSTRALIAN DISTRIBUTOR

DELSOUND

1 WICKHAM TERRACE, BRISBANE 4000.

PH: (07) 229-6155

YOUR ONE-STOP ELECTRONICS SUPPLIER

K9 19 x 20 mm

K9 — Matt black finish available in push-on or screw-fix. Push on caps, available colours red, black, white, blue, yellow, orange, grey or green.



K9PF 1+ 100+ (incl. cap) 41c 31c **K9SF** 57c 47c

(incl. cap) + tax 20%

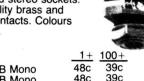




Quicktest
Ideal for w/shops
and test depts.
\$26.00
plus tax 7.5%

S2 Series

S2 range 6.5 mm nylon mono and stereo sockets. High quality brass and Nickel contacts. Colours available.



 S2 BNB Mono
 48c
 39c

 S2 SNB Mono
 48c
 39c

 S2 BBB Stereo
 61c
 49c

 S2 SSS Stereo
 48c
 36c

Specify colours + 20% tax

ALL ELECTRONIC COMPONENTS

118-122 LONSDALE STREET, MELBOURNE, VIC. 3000, AUSTRALIA. Telephone 662 3506

KIT SPECIALISTS — AND HERE'S MORE POWER TO YOU!!!

"THE BRUTE"—ETI 466—DEVELOPS 300W INTO 4 ohms, 200W INTO 8 ohms

For many audio applications there's no substitute for sheer power. This high power amp affords the full flavour of the dynamic range. This is a "SUPER POWER" module.

PRICE \$107.56 (MODULE ONLY)

ETI 467—FOUR INPUT GUITAR/MIC. PREAMP TO SUIT THE ETI 466 MODULE

Features BASS, PRESENCE, TREBLE and is simple to construct.

ETI JULY 80 \$67.78

ETI 499 (Mar. 82) GENERAL PURPOSE 150 WATT MOSFET POWER AMP MODULE

Here's a high power, general purpose power amp module for guitar and PA applications, employing rugged, reliable MOSFETS in the output.

PRICE \$96.62 (MODULE ONLY)

ETI 498/499 (June 82) VERSATILE PUBLIC ADDRESS AMPLIFIER

Featuring speech filtering and ALC on the mic. inputs to improve intelligibility, an "insert" input and a power MOSFET output stage. 150W RMS MAX. output to 100V, 70V or low impedance lines.

PRICE \$279.90

ETI 477 (Jan. 81) MOSFET POWER AMP

This power amp features a "no compromise" design. is rated to deliver 150W RMS, and features extremely low harmonic, transient and intermodulation distortion.

PRICE \$72.07 (MODULE ONLY)

EA (Dec. 84) VERSATILE EPROM COPIER/ **PROGRAMMER**

This unit is easy to build and can program 2716 and 2732 Eproms, and copy 2708, 2716 and 2732

INCLUDES F/P, plugpack, and two gold Z.I.F.'s.

PRICE \$128.00

EA (Jan. 85) MULTISECTOR BURGLAR ALARM

Easy construction, 8 separate inputs, individual sector control, battery backup and a self test facility. INCL. silk screened case, lock, keyswitch, battery, panels, speaker, etc....

PRICE \$211.00

EA (May 85) DELUXE CAR BURGLAR ALARM

New state-of-the-art car burglar alarm features keyswitch operation, delayed entry and exit, automatic reset, and provision for auxiliary battery. INCL. speaker, F/P, case, etc. . . .

PRICE \$89.54

ETI 340 (Apr. 84) VERSATILE VEHICLE SECURITY ALARM —PROVIDES FULL PROTECTION FOR ALMOST ANY VEHICLE

Does not rely on voltage or current sensing to trip alarm but on resonance microphones. Can also protect accessories such as driving lights!

PRICE \$67.47 incl. 2 mics.

EA (Aug. 84) ULTRASONIC MOVEMENT DETECTOR

This kit provides added protection against illegal entry. It will trigger if a window is broken, or there is any movement.

PRICE \$35.86 incl. sensors

Importers

General Sales

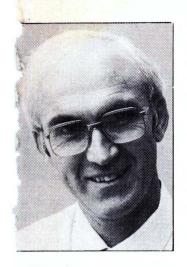
Radio Equipment Microwave Equipment

Radar Equipment

Pulse Techniques

Industrial Electronics

Instrumentation



WE know what's right for you — and you WILL enjoy it!

by Jim Rowe

LOOK PRETTY BENIGN up there, on't I? Well, you can fake all sorts of hings with photography. Right now, as I sit own to write this, I'm hopping mad. I've ready given the original June copy for this olumn to David Kelly a week ago, and it's robably set by now. But never mind, it can vait. I wanted to get this off my chest before it went cold.

You'd think someone my age would be retty used to the arrogant paternalism of ur Aussie bureaucrats by now, wouldn't ou? It's hardly something that started last week. Perhaps I'm a particularly slow learn
r, because it still gets up my nose.

Probably because I've been involved in the electronics industry for 25 odd years, it's the actions of the bureaucrats and technorats in Telecom and the Department of communications that most rub me up the trong way. I guess it's because, like you, more in a position to put their actions to context.

What am I leading up to? I'll tell you. It's story set in a fairly remote little town alled Elliston, in the south-west of South australia. It was told last night (as I write) in the ABC-TV program "Country Wide".

Apparently the people of Elliston have lways wanted to get decent TV reception — not an unreasonable expectation in the 1980s, surely. But as the nearest stations were over 70 km away in any direction, it asn't been easy. Even putting up elaborate owers and fancy aerial arrays only got them rague, barely recognizable shapes moving arough a barrage of snow.

Tests apparently showed that a decent erial and a VHF-to-UHF translator on a earby hill would solve the problem. So, for the last seven years or so, they've been rying to get the authorities to provide such set-up. Without success.

Finally they decided to whip around nongst themselves, and raise the \$25,000 so needed to put up a translator. They d it all legally — got all the information d a permit from the DOC, used approved quipment, and had an experienced supiler install it all. They were led to believe hat if it worked out OK, a proper DOC icence for the set-up would be only a

formality.

Soon came the great day to turn it on, and the whole community gathered in the local club hall. The switch was duly thrown, and for the first time they were able to see live TV reception as it should be seen. Fantastic! It had cost them \$25,000, but it was worth it. They were delighted, and also proud of themselves for having had the initiative to 'do it themselves'. As they had every right to be, of course. Australia needs more people like them.

But the smiles didn't last long. A week or two later, they discovered that the DOC was not only inviting applications for *their* translator licence from all and sundry, but also stressing that any translator built would have to be changed for satellite reception as soon as the Aussat satellite becomes operational. When they enquired, they found that such a conversion would cost another \$35,000 or so. Why hadn't DOC mentioned this before they'd blown their money?

"Country Wide" interviewed a rather smarmy DOC engineer, who explained that Elliston was outside the service areas claimed by the nearest licensed stations. Therefore, by definition, they were a remote community, and it was for such communities that the satellite was intended. When operational it would give such communities the best possible reception, and that was why the translator would have to be changed!

Needless to say, the good people of Elliston aren't too impressed with this glaring example of bureaucratic totalitarianism. They're quite happy with the vastly improved reception they're getting now from the existing VHF/UHF translator, thank you very much, and they're going to fight DOC to keep it going. Bravo!

They've got every right right to be cranky with the DOC, of course. In the first place DOC itself should have done something sooner to help the community get better reception — that would have been the best possible way to justify its existence. But then when the Elliston people finally gave up and decided to do it themselves, and asked DOC for advice and permission to set up the translator, why the bloody hell didn't one of these seat-polishing paternalists tell them that supposedly a VHF/UHF transla-

tor could only be given a temporary licence?

Even that's not what is really getting up my nose about this story. It's not the bungling, but the arrogance: the way DOC assumes that it alone knows what is best for the Elliston people, and that it apparently has the authority to force its technocratic will upon them.

Bugger the people of Elliston — what would they know about it? Sure, they might be perfectly happy now with their dramatically improved reception, but WE the experts at DOC know that once the satellite is up, they could get an improved signal-tonoise ratio. Why, our calculations show at least 4.7521 dB theoretical improvement. So they'll just have to change their translator over. Stiff cheese — serves them right for not waiting until we got around to sorting out their problems properly!

What an arrogation of bureaucratic power. Surely the people of Elliston are the best judges of whether their existing VHF/UHF translator is good enough? They had to pay for the bloody thing after all, out of their own pockets. If they're quite happy with the reception they're getting, what right does some obviously underworked DOC seat-polisher have to force them to spend more money to upgrade it?

The fact is, of course, that if the reception they're getting now via the VHF/UHF translator is perfectly OK, it won't be one iota less satisfactory when the satellite is operating. It might even be better, if the stations feeding the translator get some of their programs direct from the satellite. So from the technical point of view, there's no earthly reason why the Elliston translator should be changed if the people of Elliston don't want to. No extra-terrestrial reason, either!

It's another example of DOC paternalism run rampant, and I hope ETI readers will join me in condemning it. What'll we have next — DOC stormtroopers blitzkrieging Elliston and forcibly smashing down their verboten translator?

PERIODICALLY, just after April, when everyone realizes that it's time to think of another April fools joke, we get flooded with millions of press releases. Many of them are true. Many are not. People who entered the program for the Dynachromics Generator in our April edition will understand what I mean.

Just for the hell of it, here is something else we received from Moora WA (No, I don't know where it is either). Apparently, the Swedish company Lirpa Luf A.G., well known makers of plastic products has announced the densest recording medium known. It's called the FIK disk, or FD for short.

Apparently, FD technology is very similar to CD technology. However, instead of engraving pits on a mirror surface, it deposits tiny mirrors on an optically clear surface. Twenty of these glass discs can then be stacked together and fused by heating to form a solid lump of material.

The FD is mounted on a Random Access Terminal, and the encoded data read off as the FD spins beneath a laser pickup. A large convergence lens and a high speed servo mechanism focus the beam sequentially on the individual layers as the disc spins. The mirrors reflect the signals back to

the receive head. Here they are decoded in the normal way.

To simplify development and marketing, the system uses the same decoding circuits as CD, with sampling at 44.2 kHz and a brick wall filter slaming down just over 20k. However, the amount of information that can be stored in a given area is much increased.

The marketing department at Lirpa Luf is still trying to work out a name for the device. Front runners at the moment appear to be VLA (very large amounts) or Hugea-byte.

Meanwhile there are a few software problems to be worked out. It can hold three Sydney Telephone directories, for a start. Why would anyone want three Sydney telephone directories? Not that lack of a use has stopped great developments before. Read the press at the time and it's obvious no one could forsee the use of telephones, or radio or TV

In fact if you read *Wireless Weekly* for 2 September, 1927 you will find some very sage words from the editor on the future of television. This worthy notes that some prominence has been given in the non-technical press to the subject of television. Us technical people realize that this should

properly be called radio-vision, since it simply an application of radio transmisions. True, he notes, there have been sor demonstrations of the new art of "looki in", of more or less promising success, be no-one has been able to show how the could be applied with reasonable simpliciand economy. Nor has anyone been able suggest a practical use for it.

From this view of history we can all so what TV is for. Just consider all the ingonuity that went into the design and construction of the TV system, so you coul watch *Perfect Match* and *Blankety Blant* and have some clown tell you you're madyou don't "go lotto", whatever that might mean.

Will the same happen to the FD. I hop not. One sees it being applied to all sorts onecessary things. The entire works of Dic ens could be held on one side. Two dis would hold your complete Shakespear Three discs would tell your optometrist a he needed to know about repairing eye that had been overstrained by watchin computer screens for too long.

Imagination is the only limit to the appl cation of this type of technology. Discuss with your friends. And don't forget to to them you read it in the "Dregs" column!



HPM 240V Soldering Iron with Stand

Look at this for value! A top quality soldering iron complete with its own stand. Just plug it into the 240V AC mains and it will deliver 25W for fast efficient soldering. A well balanced tool for fine work. The workshop wouldn't be the same without one!

WAS 24.95 \$ **4 4**95

HPM 12V Car Iron

A light, compact tool ideal for those on-the-road or in-the-car jobs. Complete with 4.5 metre cord, crocodile clips and professional soldering instructions. 12V/25W. This iron is easy to handle and will take interchangeable tips in three sizes. Keep one in the boot so a breakdown doesn't spoil your holidays. Cat T-1802



Tap Set

5 piece metric tap set: 'pigeon pair' to our die set. Also contains 2, 3, 4 and 5mm taps and 4 jaw tap holder. Housed in plastic wallet for safe keeping. Cat T-4910





High Resolution Green or Amber Monitors

If you don't need colour, here's the best choice: high res monitors in your choice of green or amber phosphors. (Personal preference of operators means a lot!) Ideal for use with most microcomputers, standard composite video input.

BONUS!
FREE MONITOR
SWIVEL BASE
INCLUDED-VALUED
AT \$29.50!

\$249

STORE LOCATIONS

NSW								
Cnr. Swift & Young Sts.	Albury	21 8399	125 York St	Sydney	267 9111	Gympie & Hamilton Rds	Chermside	359 6255
T55 Terrace Level	Bankstown Sq.	707 4888	Brisbane St & Kable Ave	Tamworth	66 1961	Cnr Queen Elizabeth Dr & Bernard St	Rockhampton	27 9644
Shop 1, 65-75 Main St	Blacktown	671 7722	263 Keira St	Wollongong	28 3800	Cnr Gold Coast Hwy & Welch St	Southport	32 9863
613 Princess Hwy	Blakehurst	546 7744	ACT			Bowen & Ruthven Sts	Toowoomba	38 4300
Oxford & Adelaide Sts	Bondi Junction	387 1444	96 Gladstone St	Fyshwick	80 4944	Ingham Rd & Cowley St. West End	Townsville	72 5722
531 Pittwater Rd	Brookvale	93 0441	VIC			SA		
Campbelltown Mall, Queen St	Campbelltown	27 2199	Creswick Rd & Webster St	Ballarat	31 5433	Wright & Market Sts	Adelaide	212 1962
Shop 235, Archer St Entrance	Chatswood Chase	411 1955	145 McCrae St	Bendigo	43 0388	Main South & Flagstaff Rds	Darlington	298 8977
147 Hume Hwy	Chullora	642 8922	Shop 46, Box Hill Central, Main St	Box Hill	890 0699	Main North Rd & Darlington St	Enfield	260 6088
162 Pacific Hwy	Gore Hill	439 5311	Cnr Hawthorn Rd & Nepean Hwy	East Brighton	592 2366	24 Park Terrace	Salisbury	281 1593
315 Mann St	Gosford	25 0235	260 Sydney Rd	Coburg	383 4455	WA		
4 Florence St	Hornsby	477 6633	1150 Mt Alexander Rd	Essendon	379 7444	Wharf St & Albany Hwy	Cannington	451 8666
Elizabeth Dr & Bathurst St	Liverpool	600 9888	Nepean Hwy & Ross Smith Ave	Frankston	783 9144	66 Adelaide St	Fremantle	335 9733
450 High St	Maitland	33 7866	205 Melbourne Rd	Geelong	78 6766	William St & Robinson Ave	North Perth	328 6944
173 Maitland Rd, Tighes Hill	Newcastle	61 1896	291-293 Elizabeth St	Melbourne	67 9834	Centreway Acde, Hay St	Perth City	321 4357
Lane Cove & Waterloo Rds	North Ryde	88 3855	Bridge Rd & The Boulevarde	Richmond	428 1614	TAS		
George & Smith Sts	Parramatta	689 2188	Springvale & Dandenong Rds	Springvale	547 0522	25 Barrack St	Hobart	31 0800
The Gateway, High & Henry Sts	Penrith	32 3400	QLD			NT		
818 George St	Railway Sq	211 3777	293 Adelaide St	Brisbane	229 9377	17 Stuart Hwy	Stuart Park	81 1977
6 Bridge St	Sydney	27 5051	166 Logan Rd	Buranda	391 6233	Watch for a new store openin	g in your area!	

Dear Customers,

Quite often the products we advertise are so popular they run out within a few days or unforeseen circumstances might hold up shipments so that advertised lines are not in the stores by the time the advert appears. And very occasionally, an error might slip through our checks and appear in the advert (after all, we re human too!) Please don't blame the store manager or staff, they cannot solve a dock strike on the other side of the world, nor fix an error that is appeared in print. If you're about to drive across town to pick up an advertised line, why not play it safe and give them a call first. Just in case! Thanks. Dick Smith Electronics

MAJOR RESELLERS

NSW:• Ballina: A. Cummings & Co. 91-93 River St 86 2284 • Bathurst: Electronic Shop, 74 Bentick Street, 31 4421 • Bowral: Barry Gash Electronics, 370 Bong St 61 2577 • Broken Hill: Hobbies & Electronics, 370 xide St 88 4098 • Charlestown: Newtronics 131 Pacific Hwy 43 9600 • Coffs Harbour: Coffs Harbour: Coffs Harbour: Coffs Harbour: Descriptions of the Coffs Harbour: Coffs Harbour: Coffs Harbour: Coffs Harbour: Coffs Harbour: Coffs Harbour: Descriptions of the Coffs Harbour: Coffs

DSXpress Order Service Order with your Bankcard, Mastercard or Visacard. Just phone 008 22610 toll free for fast 24 hour despatch!
Enquiries: By mail, or phone (02)888 3200.

Terms available to approved applicants A Custom

SA Customers: Credit facilities available through C.C.C. 722 King William Street, Adelaide

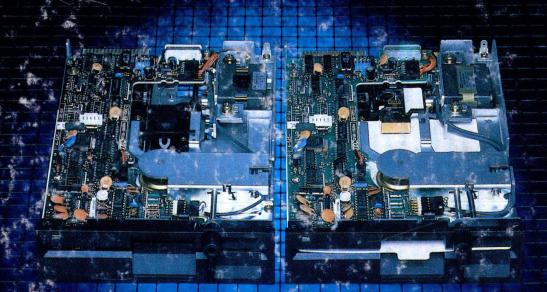


PTY LTD

P.O. Box 321, North Ryde, N.S.W. 2113. Tel: 888 3200

SIEMENS

The better the drive, the smaller the disc



True half height 51/4" floppy disc drives competitively priced from Siemens.

Designed for office electronics, business computers and OEM applications, this slim-line FB500 series has four versions with unformatted storage capacities from 250 K to 1 M bytes. Apart from compactness, these drives offer

fast access time by an advanced stepping motor and steel belt mechanism. The brushless direct drive DC motor is highly reliable and very quiet. The full range is now in stock together with Siemens relentless determination to provide complete service and technical assistance throughout Australia.

Siemens Ltd.

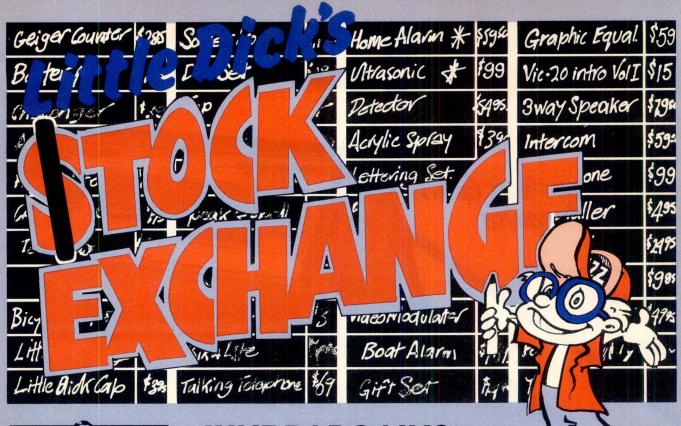
544 Church Street, Richmond, Vic. Melbourne: 420 7318. Sydney: 436 8730. Brisbane: 369 9666. Perth: 362 0123.

Distributors

Auckland: Delphi Industries Limited. 567 258
Adelaide: R.G. Pank Pty. Ltd. 51 2411
Adelaide: Protronics Pty. Ltd. 212 3111
Brisbane: ECQ Electronics. 376 5677
Melbourne: Promark Electronics Pty. Ltd. 878 1255
Perth: Reserve Electronics. 328 9755
Sydney: Promark Electronics Pty. Ltd. 439 6477.

Siemens. The discs may be flexible, but never our standards.

646/1189A



DICK SMITH ELECTRONICS

JUNE BARGAINS



40 Channel AM CB ...and something for free!

World famous Midland's mini powerhouse! Only $160 \times 120 \times 35$ mm yet it packs one heck-of-a punch. Full 40 channels and maximum legal power! Large fluoro channel display plus huge signal strength/power meter make this easy to use. Get in now while we're paying a special dividend.....

\$125

FREE

DS Australian CB Handbook with every Midland CB.
You'll save \$\$\$! VALUED AT \$5.95





Bottom drops out of bicycle computers ...all time low price!

SAVE over \$15 on our fantastic bicycle computer! Measures distance, speed, time and even averages them. A high precision instrument, ideal for the serious competitor or for the not so serious fun lover!

\$3950

Cat L-5108

So you don't **CRASH...**we're throwing in this Bika-Lite safety wand. Absolutely

*TREE! That means you SAVE \$20. That's a smart investment! Cat Y-3010



HUGE SAVINGS!

TOP PROJECTS
Vol. 7



Secure Investment... with plenty to offer!

The alarm that can go with you! Just plug it in and you've got instant protection - NO wiring, NO troubles! Fantastic for single room protection or use as a sensor on a master alarm console.

Everyone who buys an ultrasonic alarm gets a fantastic, high output HORN SPEAKER (Cat C-2705)

for...**NOTHING!** That's right FREE! Cat L-5108

VALUED AT \$11.95



On Sale from 1/6/85 to 29/6/85 unless sold out!

You can Share in the Great Computer BOOM

Hardware! Software!

Cash in on these Great Hi Tech Bargains

See your nearest DSE Bargain Broker Now!

Hurry in: While stocks

Dattasette

PRIME RATES The VIC comes equipped with a tape cassette interface which lets you connect the Commodore tape unit directly into the computer. With this ability you can load, store and retrieve data on standard cassette tape. Cat X-2005

Expansion Module

You can connect up to 6 different expansion cartridges at once! Connect the 16K, 8K and 3K expansion cartridges together—increase the VIC-20's capabilities to its maximum capacity or 32K, PLUS you may connect Interface Cartridges at the same time. Cat X-2011

WAS \$99

AN INTRODUCTION TO BASIC: PART 1

Buyers Reap the Benefits!

| VIC-20 AN INTRODUCTION TO BASIC PART 2 | B-2001 | \$28.60 | \$15.00 | VIC-20 AN INTRODUCTION TO BASIC PART 1 | B-2002 | \$28.60 | \$15.00 | VIC-20 PROGRAM REFERENCE GUIDE | B-2004 | \$11.90 | \$9.50 | VIC-20 PROGRAM REFERENCE B-2015 | \$15.00 | \$11.95 | \$15.00 | VIC-20 EXPOSED | B-2010 | \$14.50 | \$15.00 | VIC-20 EXPOSED | B-2011 | \$3.95 | \$15.00 | VIC-20 EXPOSED | B-2011 | \$3.95 | \$15.00 | VIC-20 EXPOSED | B-2011 | \$3.95 | \$15.00 | VIC-20 EXPOSED | B-2011 | \$3.95 | \$15.00 | VIC-20 EXPOSED | B-2011 | \$3.95 | \$15.00 | VIC-20 EXPOSED | B-2011 | \$3.95 | \$15.00 | VIC-20 EXPOSED | B-2012 | \$3.95 | \$2.95 | VIC-20 EXPOSED | B-2012 | \$3.95 | \$2.95 | VIC-20 EXPOSED | B-2012 | \$3.95 | \$2.95 | VIC-20 EXPOSED | B-2012 | \$3.95 | \$2.95 | VIC-20 EXPOSED | B-2014 | \$3.95 | \$19.95 | VIC-20 EXPOSED | B-2014 | \$3.95 | VIC-20 EXPOSED | HOW TO OPERATE THE IBM PC
THE IBM-PC CONNECTION
THE LAST GREAT AVIATION ADVENTURE
THE EARTH BENEATH ME, D SMITH

SMALL INVESTORS

MIGSO SAVE \$20 ONLY

World-famous Commodore Vic-20 computer at an unbelievable price! We've bought the entire stock of Commodore Australia—and we're passing the savings on to you. Look below for our large range of Commodore software and peripherals at similar savings, too. Hurry — strictly limited stock! Don't miss out on this one! Cat X-2000

VIC 20 Programs

Addition Invaders	X-2030	\$4.95
Subtraction Invaders	X-2031	\$4.95
Division Invaders	X-2033	\$4.95
English Invaders	X-2034	\$4.95
Metagalactic Llamas	X-2105	\$6.95
Abductor	X-2106	\$6.95
O		

Clowns	X-2062	\$9.95
Supersmash	X-2064	\$9.95
Assorted Titles	X-2088	\$9.95
Home Babysitter	X-2099	\$9.95
Donkey Kong	X-2111	\$14.95

Joysticks

Cat X-2004

\$19.95

8K Expansion

With the 8K memory expander cartridge you can increase your VIC-20's memory to 13K RAM. Cat X-2016

WAS \$49 \$70

16K Expansion

Or increase the memory to 21K RAM with the 16K memory expander cartridge. Just plugs directly into the VIC-20. Cat X-2017

Commodore 64 ... Price Tumbles! Dick does it again! Famous Commodore 64 personal computer at a huge saving. And we

have limited stock available right now! Don't take chances: buy from the computer experts and save! Cat X-6401

WAS \$449



Cocoa Edula Tape/Disk X-6418

Moondust Cartridge X-6457 \$19.95 Practicalc Disk X-6472 \$60.00 Master Type Disk X-6474 \$39.00

OWN A WALKMAN?

Fantastic, aren't they? Until you want to listen without the headphones. Then they're about as useful as barnacles on a boat, problem solved: the Dick Smith Electronics way! Plug your walkie stereor radio into this 2 watt amplifier – and you're away. And 2 watts is more than the average cassette player or radio gives you. What a blast! A GREAT PORTABLE PA!



ONLY 3900

Cat F-2033

DSE LEADS MARKET!

HEADLIGHT REMINDER

Easy to install it reminds you when you've left the headlights on. No more flat batteries and push starts. Cat.A-8509

2. Auto Reverse Stereo Cassette

Say goodbye to tape changing! This AUTO reverse cassette plays the other side for you. Includes superb quality 'phones. All this freedom and quality at a basement



YOU SAVE!

A superbly elegant knob in bright aluminium with fine vertical lines around the body. 35mm diam.

19mm deep.



Budget Daisywheel

STAR DP 515 **Dot Matrix Printer**

Even more performance! Handle text or graphics with ease - with the magnificent STAR DP 515: its quality design and construction will ensure long, trouble free life. 96 column format with a print speed of 100 characters per second, it's ideal for printing invoices, reports, etc etc in business & industry - or for the computer enthusiast Suits paper widths from 20 to 38.1cm, with normal or enlarged print. These advanced features are yours at a budget price.

WAS \$699

MOTORCYCLE INTERCOM

the bike is in motion. No more sign language. Fits neatly under your helmet. Cat. F-1000

Here's another educational bargain! This fantastic solar energy kit contains all you need for kids 10 and up. It will show them the possibilities of solar power. Don't miss this for the best value under the sun!

ellite Receiver



Because conditions in Australia for receiving satellite TV are not exactly optimal (in fact many books say it's impossible - we proved them wrong!) you need a special receiver. We took a proven commercial design and modified it with our exclusive PLL threshold extension circuitry (to lock onto low level signals). We 've also crystal locked the audio and modified the bandwidth circuitry to give improved signal to noise ratio; provided continuous transponder tuning with a fine tuning control and 'S' meter to assist. Output is standard composite video of the type being received from the satellite (eg NTSC from USA, PAL from Australia, etc). Cat D-8100

AMAZING VALUE!

70 MHz input level -35 to -5dBm bandwidth 12MHz

Threshold: less than 6dB C/N
Video: De-emphasis is 625 line PAL
Output 1V P-P adjustable Output impedance 75 ohms Switchable output polarity 40dB energy dispersion removal Subcarrier 5.4 to 8.0 MHz (tunable) (Crystal preset 6.8MHz): 75 microsecond de-emphasis 600 ohm unbal, output impedance -5dBm nominal output level

DOWNCONVERTER-

Input frequency range:3.7-4.2GHz Input level: -30 to -50dB

Noise Figure: Image Rejection: IF output:

Audio

-30 to -50dBm at 50 ohms 15dB nominal 18dB nominal 70 MHz, 75 ohms

15 to 18V DC

CHAPPARAL FEED HORN

The feed horn is also an essential part of the system, being replaced at the focal point of the receiving dish. It acts as a 'collecter' of signal ready for processing by the Low Noise Amplifier. Obviously the feed horn must be manufactured to incredibly tight tolerances to perform properly. The feed horn chosen for Satlink System is the famous Chapparal Super Feed, regarded in the United States as the industry standard Polarisation correction is fitted to allow reception of signals from the Intelsat satellites. Cat D-8200



An oscilloscope everyone can afford!

Every hobbyist knows how valuable a good oscilloscope is: probably the most useful piece of test gear you can own. At last we've been able to obtain a new 6.5MHz CRO, at a bargain price. Here's what it offers:

- Retrace blanking for a much clearer display 10mV per division vertical sensitivity 500mV per division horizontal sensitivity 10Hz to 100kHz timebase (in 4 ranges) Internal or external sync And a usable response to beyond 6.5MHz!

Ideal for the bench, in service work, the class-room and assembly applications. Solid state electronics (apart from the tube) means fast warm-up and extremely low drift. Cat Q-1280

RECORD LOW!

Take full advantage of the economic recovery by increasing your office efficiency NOW! This remarkable phone will store and automatically dial up to 80 numbers for you quickly and error-free! Think of the convenience and the money you'll save! Of course, it's also a superb push-button phone with last number re-

40W (Pk) PA AMP

For the really big jobs! This top quality, powerful 45W, AC/DC amplifier is ideal for halls, scout groups, fetes, schools or just about anywhere you need to make yourself heard. With all the features you'll ever need in a PA it features 2 mic jacks with separate volume controls, Aux volume control, master volume control, common rail driving system (70V & 100V) as well as 4, 8, & 16 ohm outputs. Plus - 2 bridged auxiliary input sockets. All this housed in a heavy duty metal case complete with 240V power cord.

Output power

20W RMS, 40W Peak Input & sensitivity Mic 1-2:2mV/12K ohms. Aux. 100mV/33K ohms

Operating voltage 240V AC or 12V DC **Dimensions** Weight

253(w) x 68(h) x 156(d)mm. 3.1kg.

includes

FREE

So Telephone number memory storage. Programmable security lock for STD/ISD barring. Access pause for PABX. Ringer ON/OFF switch. Last number re-dial. Re-dial number transferable to memory. Mute switch for privacy. Push-button dialling. Essential for the busy office – even for the home! No more costly wrong numbers! Cat F-5165

Telecom Permit No. C83/33/108

New From Arlec . . .

itation Wireless Intercom

No wiring! Just plug into the power point and you're ready to keep in touch any-where in the home, office . . . anywhere there's a main socket*!
*On the same phase

WERE \$89.95

High efficiency FM system for crisp, clear sound: and because it uses the mains wiring already in the building, you don't have to install a thing.!

Complete with transmit lock

switch so you can monitor nursery, sick room, etc. Great value: and the system can be extended to take up Cat F-1011

between antenna lead-in receiver/transmitter and grounds excessive potentials. On e PL-259 plug and SO-239 type socket, and large grounding screw.

TAKE UP YOUR OPTIONS! NOW

WAS \$4.20

Cat. D-7152



Cat K-3098

Anyone for tennis?

Not even Mcwhats-is-name would dispute this! Ingenious magnetic pick-up circuit senses any sharp vibration of the net (eg when a ball hits it!) and sounds a beeper. Not affected by wind. Fully portable, too - take it wherever you play

National Recorder

High quality mono recorder suitable for computer use to store your pro-grams and data. 240V AC mains lead supplied or will run off 4 'C' sized batteries (not supplied). Features single touch record button and mechanical

CASIO CALCULATOR With Time

The perfect pocket size! Time display showing hours, minutes and seconds. PLUS all the basic arithmetic functions with memory, square roots and percentages in a unit that takes up next to no space at all. Features; 8 digit display. Floating decimal point. Overflow check and LCD for long battery life and easy to read display. Ideal for anyone who needs to make quick calculations while they're



Cat Q-3040

Monitor 4 Geiger Counter super value!

A miniature geiger counter useful for research, education and personal pro-tection in laboratories, hospitals, etc. Sensitive to a broad spectrum range of ionizing radiation including alpha, beta, gamma and x-rays. Switching range -0.5mR/hr to 50mR/hr. Extra long battery life. Complete with operating manual. This is an accurate scientific instrument at an affordable price. Cat Q1000

60W Stereo Booster with Graphic Equaliser!



Your car is about the worst listening room imaginable. No wonder so may car stereos sound awful! Now! you can 'contour' the sound to make up for your vehicle's interior and boost its power up to a huge 30 watts per channel with this attractive Graphic Equaliser/Stereo Amilifer. Now you're talking! Has 7 individually adjustable frequency bands - up to 12 dB cut or boost in any band. LED level meters for each channel show power output and 4 speaker front/rear fader control for 'all around' sound. You won't believe the difference this equaliser can make! Specifications: Frequency response... 35-25,000 Hz. Crosstalk... 45dB. Power Source Voltage... 11-16VDC (neg. earth). Dimensions...155(w) x 22(h) x 140(d)mm. Weight... 950g.

Page 5

High-output

Calling all boat owners. Amateur operators. Technicians. And anyone else who's ever had to keep a 12V battery charged in an out-of-the-way place: Here's the first solar cell we've seen that combines both usable output AND reasonable cost. We've seen similar panels to these advertised elsewhere for \$100 more!

2 x 10V at 450mA (20V at 450mA or 10V at 900mA)

Diode protected.

Cat Z-4844

MARKET DROPS!

Bargain Belt Drives



ENERGY APPROVED

AUTHORITY

Records a bit slow? Most of your music taking on the Chipmunks sound? Try this top quality belt drive turntable. Fully automatic 240V model which includes record size selector, anti skate and weight adjustment. PLUS superior ADC magnetic cartridge. Ideal replacement for that old rim drive! Cat A-3010

BSR QUALITY

Kids giving your turntable a hard time? Why not get a second one just so they can use it. This ECONOMY 12V belt drive is ideal as a second unit (or even a first one!). Complete with electronic speed control and quality magnetic cartridge. Great for dubbing! Fantastic value!



PRICES BLITT Electronic Capacitors ONE ORDER ONLY LIMITED STOCK J. 1030 PHONE ORDER ONLY - LIMITED A C. 24

1.00 All one Cat No. 10,000uF

2001 888 2708 2286 10 Tall Free OOOUF 7,000 ur



CLEAR **ACRYLIC SPRAY**

A fine colourless spray that is ideal for the protection of front panels, etched screen print or Letraset lettering. Will moisture proof components, TV aerial terminations etc. 125 gram can. Cat N-1011

> **IDEAL FOR ARTISTS TOO**

MATTE BLACK **SPRAY PAINT**

A quick drying matte finish spray. Suitable for giving your project that professional your project that professional finish. Ideal for spraying heat-sinks to increase thermal efficiency. 175 grams. Cat N-1070



the project itself. Cat M-9555

2V AC @ 500mA

Ideal power supply for projects that require 12V AC at 500mA. Because the

whole of the plug-pack is a transformer,

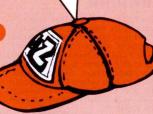
you get a much higher current rating than other plug-packs. Rectifiers and filter components can be placed inside

ittle Dicks own

Now you too can be a Wizz . . just like Little Dick. One size fits all. Cat Y-9950







12 V 1.2 Ah

A mini Gel Cell intended mainly for alarm applications (fits inside alarm cases nicely) with enough oomph for most applications. Colour-coded spade connectors for easy connection, size 100 x 45 x 55mm.
As used in EA Home Burglar Alarm kit.
Cat S-3315

No leak, rechargeable



Little Dick Fan Club Badges

Show your friends you're a Little Dick fan. Wizzo!

RECORD LOW!

'Bookshelf' **Alarm Module**

A great alarm system for the home, flat, etc -because it doesn't look like an alarm! So anyone entering your property could easily be fooled into thinking this was a small speaker - until they were caught! This module has another big advantage apart from the sensors, it's fully contained.



Cat L-5102

Pen Watch & **Calculator** Gift Set

Elegantly styled case containing pen watch similar to above PLUS attractive LCD calculator. Ideal for the executive, the student . and the inside of the lid is mirror finished for milady's emergency make-up repairs! Cat. Y-1059

TELECOM DIRECT CONNECT PERMITTED Low Cost Answer-Only Machine

Save a fortune with this new concept in telephone service. Doctors, solicitors, businessmen (and women)... whenever you're away from the office, home, etc., just program this machine to tell callers when you will be returning, where you can be reached or to call back later. And it's all done electronically with amazing microprocessor-controlled crystal clear synthesised speech. Uses no tapes or records!



WAS \$99.50

The Bika-Lite safety wand

Here's top value for any kid from 6 to 66 with a push-bike. The Bika-Lite is a flexible acrylic wand that glows: and that means they can be seen from afar

a must in today's traffic. It lights up at night (the whole wand glows) and the dayglow flag means it can be seen during the day.

Includes fittings for all cycles and fitting instructions. Cat Y-3020

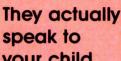
WAS \$9.95

Mini **Amplifier**

Mini amplifier for walkie stereos, radios, etc - gives you full stereo performance with huge 1.5W peak output! Battery operated power amplifier has high/low filters, LED level displays. Mini speakers have really great sound. What a beauty! Cat A-4020



speak to your child as they teach!



Math

The Speak and Math can generate over 100,000 math problems. It also talks to you, telling you whether you're right or wrong. There are challenging activities and exciting games, which makes learning fun. There are three levels of difficulty, including a beginners look at geometry. There's a colourful 32 page book 'Math Talk. The unit is battery operated with APD' (automatic power down) which turns it of automatically; or by optional AC power supply.

Boat Alarm

Boats are pretty 'hot' property - and easy targets! This versatile and durable alarm for marine applications is perhaps the most complete boat alarm offered today! Comes complete with: High impact resistant strobe light. Electronic siren. 4 sets of magnetic switches for NO & NC applications. Two lock switches with brackets. Wiring and complete instruction. In addition the DS alarm has multiple protection zones so you can extend the system to meet your requirements... **Great Value!**

Cat L-5098

Protect your boatEasy fittingExpandable to suit vour needs



3mm, 4mm and 5mm dies, plus dual hand-led die stock holder. Complete with ins-tructions. Cat T-4905

Speak and Spell" helps develop skills in spelling, pronunciation and reading. It pronounces the word — the student keys in the spelling. It tells you whether you're right or wrong and also displays your score. It has in it's vocabulary' over 200 everyday words most often misspelled. They're the words most students have trouble with. It teaches by involving: the student hears the word, spells the word and sees the word. And it's fun! A colourfull 32 page book "Fun with Words" is included, which contains spelling games and activities plus easy-to-understand instructions. Ideal for all students, from beginners up. And it does not matter if they leave the unit on: it as we batteries! Operates from 4 C-cells (not supplied) or optional AC Adaptor. Cat Y-1300

Little Dick Stock Broker



DS HORNET II Now a better investment!

Now the latest 40 channel CB technology with a massive 12 watts p.e.p. output on SSB gives you MORE Value for your dollar!

Cat D-1710

This is one of our best selling units and now it's even better than before. With every purchase of our Hornet II you get a FREE CB antenna (Cat D-4076). That's \$29.50 value!. RECORD LOW! DOC Approval No 249A006

HUGE \$29.50 SAVINGS

YAESU FV107 EXTERNAL SPECIAL

Cat D-2870

What a bargain! Designed to suit the FT107, but also suitable for use with virtually any HF transceiver - even K...d and I..m! Standard 5.5-5.0 MHz output at 150mV into 50 ohms. Has facilities for six fitted xtal locked channels as well, plus clarifier on tx, rx or both. Operates from 13.5V DC, with tons of space inside the case for project building - like a novice transceiver?



COMMUNICATION IS IN THE PALM OF YOUR HAND!

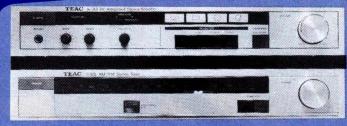


Yaesu's FT708 hand-held puts you in touch. This superb quality hand held uses 4-bit micro to control its 10 memories, LCD readout and 1W output on 70cm. Full auto or manual scanning over the band or through the memory.

With this little beauty it's all in your hands!

Cat D-2930

THE RUSH IS ON!



WHAT A GREAT PAIR! TEAC AMPLIFIER AND TUNER COMBINATION.

TEAC A-313: INTEGRATED AMPLIFIER

Superb quality, hi-tech hi fil This 22W/Ch. amplifier is DC coupled for optimum noise and distortion characteristics. Suitable for two sets of speakers with A/B/AB switching.

WAS 5520 Cat A-1310 WAS \$229 Cat A-1310

Teac T-515: AM/FM Stereo Tuner

The perfect partner for the A-313. This beautifully styled tuner is delightfully simple to operate. It even has built in recording calibration tone and it's built for correct Australian FM band.

WAS \$220 Cat A-1510

NOW

NOW



Dual Rotary Pots

Linear

50K R-6838 .80¢ 1M 500K R-6842 .80¢ 2M R-6843 .80¢ R-6844 .80¢

Log 20K R-6851 .80¢ 100K R-6855 .80¢

500K R-6857 .80¢ R-6858 .80¢ 111 R-6859 .80¢ 2M R-6876 .80¢ 1K

DEAKERS

Sensational Series 200 speakers at a new LOW price! These compact units $(317 \times 666 \times 230$ mm) are just what you need to upgrade that ageing system. Enormous 200mm woofer, 125mm midrange and 64mm tweeter give you supurb hi fi reproduction. And now they're at a lower than ever price. Take the plunge before it's too late!

WAS 5249

Cat A-2370



Speaker Grills Go Through The Floor!

Speaker grill CLEARANCE SALE. Don't miss out! At these ridiculous prices they can't last long. Ideal as replacement grills or for your own projects.

To suit Playmaster speakers (250mm) WERE \$35.90 NOW

To suit Series 200 speakers (317 666mm) WERE \$34.50 NOW

pair

Motorola Piezo Tweeter

The famous Motorola Company has come up with a magnificent quality piezo ceramic speaker at an unbeatable price! Offers high impedance: over 1000 ohms at 1kHz & above 20 ohms at 40 kHz. Frequency responce: 2500-35,000Hz / 3dB. Low distortion and clean response add up to great

Cat C-2006 WAS \$6-95



HIGH YIELD INVESTMENT!



PRIME COMMUNICATIONS **ISSUE** Affordable to everyone!

The FT77 from Yaesu is the ideal transceiver for the amateur on a tight budget. There's no fancy gadgetry in this one but there's no sacrifice in performance either.

Covers all amateur bands between 3.5 and 29.9MHz and the 3 WARC bands - with 100W output. Cash in now on great transceiver value!

WAS \$699

Cat D-2915



ALL TIME LOW PRICE! FT-102 HF ALL MODE*

(* with optional AM/FM board)

SP-102 Speaker/Filter

Save money and buy quality! This 120mm hi fi speaker with selectable low and high-cut audio filters allows 12 possible response curves. Filter allows audio tailoring for each bandwidth and mode of operation.

Cat D-2883 WAS 585

TRANSCEIVER BARGAIN!

The super high performance FT-102 HF receiver is now at an even LOWER price. Featuring all the amateur bands PLUS the WARC bands. With the special high need and now you can save \$100 off our regular price!

WAS \$999

voltage JFET RF amplifier you get exceptional dynamic range - well beyond 100db. A massive 240W gives you all the power you'll

Cat D-2880

AM/FM Board

Plug in PC to give you the added benefits of AM/FM operation. Fantastic for 6 or 2 metre transverters (Why buy another rig when you can convert youjr HF for so little?)

WAS 579.50

Cat D-2882

DON'T SPECULATE ON STYLUS QUALITY

Goldring's ES-70SH/ss gives fantastic sound reproduction with superb tracking ability, low distortion and excellent transient characteristics

For you...it sounds great! And at our amazing low price there's no excuse for ruining your valuable records. Get in for your share of quality! Cat C-2830

Famous OSAWA one of the top cartridge manufacturers brings you reliability and quality in the OS-301 moving induced stereo cartridge.

Their advanced technology brings you the ultimate in cartidge quality. The superb tracking qualities and the diamond bonded stylus combine to bring realism to your music. And at DSE we bring you the best without the big investment! Cat C-2840





D.BBB.P

The ultimate general coverage transceiver! And now you can SAVE HUNDREDS. The FT-ONE is the ALL mode (even FM with optional board), ALL band, ALL area operational, ALL microprocessor controlled transceiver that the others

DSE LEADS MARKET!

MANAGER AND THE PROPERTY OF THE PARTY OF THE

Designed especially for the larger type of transceiver in mobile use - saves it slopping about all over the carl Unique design allows for virtually any size and mounting method.Why take the risk? Get yourself a YAESU mounting bracket.

Cat D-2944

WA:

WAS \$19-50

VHF Marine Whip for 156 MHz

Antenna to suit VHF Marine Transceiver (Cat D-1401). Also

includes the special (Cat D-4057) antenna base supplied. Cat D-4016

\$67.50



COMMUNICATIONS

Yaesu's FL-6010 is a compact 6 metre linear amplifier designed to match the FT-69Or but it will be just as efficient with just about any transceiver. Suits all modes and gives 10 Watts output for 2.5 Watts input.

Yaesu quality with DSE value! You can't go wrong. Cat D-2545 WAS \$79



4 Sector Control Module

The 'bare bones' alarm controller – for the do-it-yourselfer who wants to install a top quality system without paying a fortune. You can protect four different sectors, and this alarm features circuitry complying with the latest noise pollution laws: it will re-arm itself after an alarm detection, but will isolate a sector which has permanently tripped detectors (eg broken window foil).

Instant or delayed inputs.

Wire out proof system - suitable for both n/o or n/c detectors. LED sector and control state indi-

Adjustable entry, exit and alarm

WAS \$69.50



Piezo Transducer

Sound transducer driven by 3 - 30V p-p AC signal around 40kHz (eg TTL, CMOS, etc) Sound output typically 80dB min. 5mm thick,



30mm diameter. Cat L-7022

PRICES HIT THE FLOOR!

	Туре	Description	Cat No.	WAS	NOW
-15	2114	1K × 4 static RAM	Z-9306	\$2.75	\$1.40
10	4116	16K × 1 dynamic RAM	Z-9310	\$3.25	\$1.50
10	4164	64K × 1 dynamic RAM	Z-9312	\$7.50	\$6.50
	2513	ASCII character generator	Z-9206	\$24.75	\$14.75
м	M5865N	Universal Timer IC	Z-6816	\$5.50	\$3.50

Repeater Upgrade Kit

Add-on kit to give your Explorer full repeater operating capability, plus S-meter, an additional crystal filter and a new front panel to take S-meter and repeater switching.

To bold by

MARKET DROPS

Large Piezo Electronic

Ideal for car, home, van alarms: this compact unit makes a very loud, piercing sound when activated. Easily fitted, operates from 12V DC @ 500mA. 110dB output at 1m.

\$2495

Piezo Electronic Alarm

Earsplitting siren alarm suitable for most installations. Working voltage 7.5 - 15 (200mA at 12V). Sound output 110dB at 1M. Frequency 2800Hz.

\$4 495



Warning Sign

ULTRASONIC

Protect both your vehicle and its contents with this latest alarm from Philips. Using the Doppler principle detects any movement in the car and sounds the alarm. Very reliable! Features adjustable entry delay and sensitivity control: boot and bonnet switches also included. It's easy to fit as well!

Cat. L-5082

Micro Piezo Alarm

Amazingly compact! Suitable for cars, bikes, vans or very loud local alarms. Simple installation. 12 volts operated at 120 - 240mA Output 110dB at 1m. Cat 1 -7029

\$ 4 495

Aluminium

Sign THIS PROPERTY Cat L-5312 IS UNDER CONSTANT ELECTRONIC **SURVEILLANCE**

245 x 170mm heavy duty sign, ready to warn them away in no uncertain terms. 22 gauge aluminium, screen printed in bright fire-engine red. Suitable for screwing to wall, fastening to fence, etc



Cat K-2605

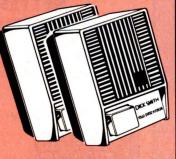
Two Station System

A highly efficient 2 station intercom is fully transistorised and can be used over any distance up to 160 metres.

Master unit has volume control and is supplied complete with slave and 16 metres of connecting cable. Either station can call even if the system is even as a baby minder between bedroom and lounge.

Cat. F1020

ONLY \$4 Q95



Here's what you get:

24 resistors • 18 capacitors (including a variable ● 24 resistors ● 18 capacitors (including a variable type) ● 2 transistors ● 1 integrated circuit ● 2 LEDs ● 1 light dependent resistor ● 1 diode ● 1 potentiometer ● 1 speaker ● 1 ferrite rod aerial ● 1 crystal earphone ● 1 audio transformer ● 1 battery clip ● hook-up wire ● baseboard ● screws & washers ● the re-usable plastic parts tray PLUS a copy of Fun Way Into Electronics, Volume 1.

All the components AND Fun Way 1 book in a great pack everything needed to build any of the projects in Fun Way 1!
PLUS our specially manufactured re-usable plastic 'breadboard' - a great way to build not only the Fun Way 1 kits, but also to 'mock-up' other circuits as you become more experienced.

AND EVEN MORE! Everything is housed in a multi-division plastic tray, which is fantastic for housing components in, both now and in the future.

The Fun Way 1 Gift Box makes an ideal birthday or Christmas present. . . and who knows: it could be the start of an absorbing lifetime hobby in electronics, or even an exciting career!

Morse Tapes

Teach yourself Morse! You'll know words within a couple of minutes. Two tapes take you up to 13 WPM. Cat D-7106

TEACH YOURSELF MORSE 6 FULL NOVICE STANDARD

REASONS WHY YOU SHOULD ORDER THROUGH DSX:

That's right! Any orders \$50 or more are delivered direct to your door, anywhere in Australia - and we pick up the tab for freight charges. It's another way DSX gives you better service and saves you money! This offer expires June 30. Don't miss out!

Doesn't matter where you live in Australia, with our toll free credit card order line, you only pay the price of a local call! You can still ring our original numer - (02) 888 2105, but if you live outside the Sydney metropolitan area we have a special toll free number - (008) 226610. Call us now - Toll Free for Fast delivery!

AVOID DELAYS: PHONE IN - FREIGHT OUT.

If you need something in a hurry you can be sure somewhere there'll be an industrial dispute to hold it up. Your urgent parcel will be sitting on some dock and you'll be left in the!

With DSX you just phone your order through (toll free) and the next day it's on its way. No mail exchange to get lost in - and if it can't go by air we'll send it by road so you know your order is on the way!



PO BOX 321 NORTH RYDE, NSW 2113. Phone Enquiries: (02) 888 3200 17 YEARS RELIABLE MAIL ORDER SERVICE

Name	Customer No.:	ſel. No	.()	······
Address	Have you changed your address? If so please print previous address here		Postcoc	de
VISA PAYMENT: Cheque Mone	y Order VISA Bankcard Mastercar Signature	d	Expiry Date	
Cat. No. Qty. Description			Item Price	Total Price
	SCIGHT -D			
EQ.	E FKE, OVER			
	SEDFK OU!!!			
O//	\$50.00.			
Delivery Instruct	ions (Please tick)	Me	rchandise Total:	
Post & Packaging	DSK _{PRESS} Freight	Paci	c & Post/Freight:	
For goods sent by standard mail in Australia only. Standard Mail (See P&P table below)	THE A SMITH SELECTION, THE SECURITY ASSESSED.		(Registration):	
☐ Airmail (Add \$4.00 to standard P&P charge)	☐ AIR \$7.00 ☐ ROAD \$10.00 (up to 4 kilos)		SUB TOTAL:	
☐ Registered Mail (Add \$4,00 to standard P&P charge) ORDER VALUE P&P CHARGES	☐ AIR \$12.00 ☐ OVERSEAS:		Less Credit:	
\$ 5.00 - \$ 9.99 \$2.00 \$10.00 - \$24.99 \$3.50 \$25.00 - \$49.99 \$4.50	(up to 10 kilos) super economy rates available		TOTAL \$	
\$50.00 - \$99.99 \$6.50 \$100.00 or more \$8.00			MINIMUN	ORDER \$5.00

IN A HURRY? XPress ORDER LINE 008 226610 Bankcard — Mastercard — Visacard Welcome.

14 DAY MONEY-BACK GUARANTEE

REAP BENEFITS!

Wizzard Accessories ... Prices Hit Rock Bottom.

48 Kev 'Moving Keyboard' When you've finished playing games this 48 key keyboard just slips into position. Now it's ready for some serious business. Cat Y-1608

Basic Cartridge

Just plug it in and you're computing in the easy to understand BASIC language — the world's most popular computer language. BONUS computer instruction manual. Cat Y-1605

Printer Interface

Cat Y-1606

WAS \$34.75

Bargain

The best news computer owners have

HUGE

SAVINGS

XIDEX Diskettes Price Decline

Don't risk loss of valuable computer data by using 'economy' floppy disks-they could cost you a fortune! The Xidex range of Precision disks offer a level of quality and reliability previously unknown.

SAVE 10%

BARGAIN Box of 10 Single Sided, d/density SOFT/s Cat X-3512 \$54.50 \$49.50

NEW

Box of 10 Double sided, d/density SOFT/s Cat X-3514 \$59.50 \$53.50 box

Disk Storage File

PRICES HIT THE FLOOR!

Wizzard Software Cassettes

Codebreaker	X-1700	\$7.95
Financial Loans	X-1705	\$7.95
Statistics 1	X-1710	\$7.95
Statistics 2	X-1715	\$7.95
Combination	X-1720	\$7.95
Draughts	X-1722	\$7.95
Bowling	X-1724	\$7.95

Cartridges

Deep Sea Adventure	Y-1625	\$19.95
Music Maker	Y-1635	\$19.95
Soccer	Y-1645	\$19.95

Dot Matrix Printer

had in years! A 40 column printer for less than \$50! Yes, of course there's a catch.

Yes, of course there's a catch, You have to supply a couple of hours labour to build the power supply yourself and connect it to the printer mechanism. So for the cost of a bit of assembly, you'll save heaps. And look what you get - 40 column Dot Matrix format. Fast 48cps print in two colours (black/red). Full ASCII character set (caps & lower case) plus Greek symbols and accent characters. Box & switches not included. Box & switches not included. Cat X-3240



BARGAIN

\$2495

VZ 200 — Buyers Haven as Prices Crash!

200 Cassette

			was	now
Matchbox	24K	X-7231	\$9.50	\$4.95
Poker	8K	X-7232	\$9.50	\$4.95
Hangman	24K	X-7233	\$9.50	\$4.95
Slot Machine	8K	X-7234	\$9.50	\$4.95
Blackjack	24K	X-7235	\$9.50	\$4.95
Biorhythm	24K	X-7237	\$9.50	\$4.95
Horse Racing	24K	X-7238	\$9.50	\$4.95
Dynasty Derby	24K	X-7240	\$9.50	\$4.95
	8K	X-7251	\$13.95	\$4.95
Statistics 1	24K	X-7252	\$13.95	\$4.95
Statistics 2				
Golf/Tennis	24K	X-7254	\$9.50	\$4.95
Elementry Geometry	24K	X-7256	\$12.50	\$4.95
Speed Reading	24K	X-7257	\$13.95	\$4.95
Portfolio Management	24K	X-7261	\$12.50	\$4.95
Discounted Cash				
Flow Analysis	8K	X-7262	\$12.50	\$4.95
Financial Rat	24K	X-7263	\$12.50	\$4.95
Checker	24K	X-7265	\$13.95	\$4.95
Hex Utilities	8K	X-7280	\$13.95	\$4.95
Spellomatic 3 & 4	8K	X-7286	\$13.95	\$4.95
Flashcard 1 & 2	8K	X-7287	\$13.95	\$4.95
	8K	X-7288	\$13.95	\$4.95
Flashcard 3 & 4	on	V-1500	A10.90	\$4.95

4 Program Pack — Entertainment X-7291 4 Program Pack — Financial X-7293

Challenger Software

X-8649 STARSHIP CHALLENGER - (Cassette)

X-8651 STYX - The swirling STYX has laid seige on the vast expanse of your playing field. Stake your claim and force the

X-8652 DIGGER - Search for buried treasures of shining gold and sparkling emeralds. With chomping jaws, your Digger Mobile must tunnel out mazes and outsmart the Nobbins!

X-8664 APPLE PANIC
X-8666 FROGGER - Get across the highway without getting run over, and across the river avoiding deadly snakes, otters, and the treacherous diving turtles
\$48.95 \$42.95 \$

X-8700 ALLIGATOR MIX - Encourages children to practice basic addition and subtraction skills while playing an exciting,

fast paced arcade game. \$54.95

X-8702 DRAGON MIX - As for Alligator Mix, but this time conconcentrates on multiplication and division skills. \$54.95

X-8750 ELECTRIC PENCIL - An easy to use yet sophisticated word processing program. Manual and Quick Reference Card included.*

*Does not operate with new X-8605 Challenger.

Printer Cable

SLASHED

This is a universal cable, ideal for connecting a printer or other device to the printer interface. Fitted with edge connector one end and 57N-36 plug NOW ONLY the other. Cat X-4014



